Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:41

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	64 m^2
Site Reference	Unit 67 L04_Copy	Plot Reference	Unit 67 L04_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*12.3 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	6.25 kgCO_2/m^2	**OK**
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*66.47 kWh$_{PE}$/m^2*	
Dwelling primary energy	68.78 kWh$_{PE}$/m^2	**FAIL**
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*25.8 kWh/m^2*	
Dwelling fabric energy efficiency	28.7 kWh/m^2	**FAIL**

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	**OK**
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	**OK**
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	21.07	0.14 **(!)**
Party wall: Party Wall (1)	37.53	0 **(!)**
Party wall: Party Wall (2)	6.68	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	7.88	North East	0.83	1.3
N, Opening Type 1	2.11	North	0.83	1.3
NW, Opening Type 1	11.81	North West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.82 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 67 L04_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 67 L04_Copy	**Prop Type Ref**	Unit 67 L04
Property			

SAP Rating	76 C	**DER**	6.25	**TER**	12.30
Environmental	95 A	**% DER < TER**			49.19
CO_2 Emissions (t/year)	0.4	**DFEE**	28.70	**TFEE**	25.80
Compliance Check	See BREL	**% DFEE < TFEE**			-11.22
% DPER < TPER	-3.48	**DPER**	68.78	**TPER**	66.47

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.6600	(1b)	x 2.4000	(2b) =	152.7840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.6600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		152.7840	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			21.8000	1.2357	26.9392			(27)
External Wall 1	42.8700	21.8000	21.0700	0.1400	2.9498	14.0000	294.9800	(29a)
Total net area of external elements Aum(A, m2)			42.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.8890			(33)
Party Wall 1			37.5300	0.0000	0.0000	20.0000	750.6000	(32)
Wall to corridor			6.6800	0.0000	0.0000	20.0000	133.6000	(32)
Party Floor 1			63.6600			80.0000	5092.8000	(32d)
Party Ceiling 1			63.6600			80.0000	5092.8000	(32b)
Internal Wall 1			123.2200			9.0000	1108.9800	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12473.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		195.9434 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	9.3800	0.0500	0.4690

E4 Jamb	27.8400	0.0500	1.3920	
E7 Party floor between dwellings (in blocks of flats)	15.8700	0.0700	1.1109	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3700	0.0000	0.0000	
E16 Corner (normal)	5.4000	0.0900	0.4860	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.7819 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 33.6709 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.2548	15.0941	14.9334	14.1298	13.9691	13.1656	13.1656	13.0049	13.4870	13.9691	14.2906	14.6120	(38)
Heat transfer coeff	48.9257	48.7650	48.6043	47.8007	47.6400	46.8365	46.8365	46.6757	47.1579	47.6400	47.9614	48.2828	(39)
Average = Sum(39)m / 12 =												47.7605	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7685	0.7660	0.7635	0.7509	0.7484	0.7357	0.7357	0.7332	0.7408	0.7484	0.7534	0.7584	(40)
HLP (average)												0.7502	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0830 (42)

Hot water usage for mixer showers

81.3240	80.1018	78.3209	74.9135	72.3989	69.5946	68.0007	69.7681	71.7056	74.7165	78.1971	81.0124	(42a)

Hot water usage for baths

25.5574	25.1778	24.6433	23.6578	22.9198	22.1016	21.6596	22.1903	22.7682	23.6438	24.6497	25.4710	(42b)

Hot water usage for other uses

35.9620	34.6543	33.3466	32.0389	30.7312	29.4235	29.4235	30.7312	32.0389	33.3466	34.6543	35.9620	(42c)

Average daily hot water use (litres/day) 131.3665 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	142.8434	139.9340	136.3109	130.6102	126.0499	121.1197	119.0838	122.6897	126.5127	131.7069	137.5011	142.4454	(44)
Energy conte	226.2290	199.2641	209.5047	178.7988	169.6874	148.9308	144.0215	151.9154	156.0028	178.7250	195.8955	223.0351	(45)
Energy content (annual)										Total = Sum(45)m =		2182.0102	
Distribution loss (46)m = 0.15 x (45)m	33.9344	29.8896	31.4257	26.8198	25.4531	22.3396	21.6032	22.7873	23.4004	26.8088	29.3843	33.4553	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
									Total per year (kWh/year) = Sum(64)m =		2429.0422	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

92.0058	81.4156	86.4450	75.6938	73.2057	65.7627	64.6718	67.2965	68.1141	76.2107	81.3784	90.9438	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.9586	18.6152	15.1389	11.4611	8.5673	7.2329	7.8154	10.1588	13.6351	17.3128	20.2066	21.5411	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	271.7527	274.5726	267.4664	252.3383	233.2416	215.2935	203.3031	200.4831	207.5893	222.7175	241.8141	259.7622	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	(71)
Water heating gains (Table 5)	123.6637	121.1542	116.1895	105.1303	98.3948	91.3371	86.9244	90.4523	94.6030	102.4338	113.0256	122.2363	(72)
Total internal gains	507.6160	505.5831	490.0359	460.1707	431.4448	405.1046	389.2840	392.3353	407.0684	433.7051	466.2874	494.7806	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1100	10.6334	0.6300	0.8270	0.7700	8.1009	(74)
Northeast	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(75)
Northwest	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(81)

Solar gains	88.3144	178.7581	320.4794	525.3714	706.3245	753.2685	704.5544	561.4605	390.0832	217.9657	110.9228	72.2597	(83)
Total gains	595.9304	684.3412	810.5153	985.5421	1137.7693	1158.3731	1093.8384	953.7958	797.1516	651.6708	577.2102	567.0403	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.8203	71.0537	71.2887	72.4871	72.7316	73.9794	73.9794	74.2341	73.4752	72.7316	72.2442	71.7632	
alpha	5.7214	5.7369	5.7526	5.8325	5.8488	5.9320	5.9320	5.9489	5.8983	5.8488	5.8163	5.7842	
util living area	0.9495	0.9033	0.7864	0.5758	0.3884	0.2587	0.1884	0.2251	0.4070	0.7170	0.9072	0.9584	(86)
MIT	20.4430	20.6297	20.8505	20.9756	20.9976	20.9998	21.0000	20.9999	20.9978	20.9371	20.6818	20.4051	(87)
Th 2	20.2807	20.2829	20.2851	20.2961	20.2983	20.3094	20.3094	20.3116	20.3050	20.2983	20.2939	20.2895	(88)
util rest of house	0.9400	0.8877	0.7604	0.5448	0.3594	0.2308	0.1588	0.1914	0.3664	0.6785	0.8895	0.9504	(89)
MIT 2	19.6501	19.8768	20.1321	20.2738	20.2964	20.3093	20.3094	20.3116	20.3035	20.2415	19.9531	19.6111	(90)
Living area fraction										fLA = Living area / (4) =		0.3699	(91)
MIT	19.9434	20.1553	20.3979	20.5334	20.5558	20.5647	20.5649	20.5662	20.5604	20.4988	20.2227	19.9048	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9434	20.1553	20.3979	20.5334	20.5558	20.5647	20.5649	20.5662	20.5604	20.4988	20.2227	19.9048	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9350	0.8847	0.7647	0.5553	0.3701	0.2411	0.1698	0.2039	0.3814	0.6898	0.8875	0.9454	(94)
Useful gains	557.2083	605.4138	619.7693	547.3032	421.0875	279.3214	185.6954	194.4496	304.0092	449.5203	512.2933	536.1066	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	765.3659	743.9254	675.4971	556.0856	421.8901	279.3673	185.6996	194.4617	304.6569	471.5806	629.3813	758.2722	(97)
Space heating kWh	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(98a)
Space heating requirement - total per year (kWh/year)												562.3385	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												562.3385	
Space heating per m2										(98c) / (4) =		8.8335	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.0817	10.0092	11.0817	10.7242	11.0817	10.7242	11.0817	11.0817	10.7242	11.0817	10.7242	11.0817	(231)
Lighting	18.3449	14.7170	13.2510	9.7083	7.4989	6.1267	6.8408	8.8919	11.5497	15.1538	17.1162	18.8548	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.3302	-24.3862	-39.3596	-49.2100	-57.7415	-55.5822	-54.6983	-49.3462	-40.2733	-29.5092	-17.6479	-12.9166	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.7432	-6.5971	-15.2405	-26.0425	-36.6010	-37.6280	-37.0950	-30.0206	-20.4973	-10.6316	-3.9607	-2.0877	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	562.3385	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2429.0422	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	130.4775	(230a)
Total electricity for the above, kWh/year	130.4775	(231)
Electricity for lighting (calculated in Appendix L)	148.0540	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-675.1465	(233)
Wind generation	0.0000	(234)

Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2594.7657	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	562.3385	16.4900	92.7296	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	16.4900	400.5491	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	130.4775	16.4900	21.5157	(249)
Energy for lighting	148.0540	16.4900	24.4141	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.0013	16.4900	-73.5456	
PV Unit electricity exported	-229.1452	5.5900	-12.8092	
Total			-86.3548	(252)
Total energy cost			452.8537	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.5003	(257)
SAP value	75.6794	
SAP rating (Section 12)	76	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	562.3385	0.1589	89.3676	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2429.0422	0.1413	343.1917	(264)
Space and water heating			432.5592	(265)
Pumps, fans and electric keep-hot	130.4775	0.1387	18.0988	(267)
Energy for lighting	148.0540	0.1443	21.3688	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.0013	0.1324	-59.0465	
PV Unit electricity exported	-229.1452	0.1229	-28.1599	
Total			-87.2065	(269)
Total CO2, kg/year			384.8203	(272)
CO2 emissions per m2			6.0400	(273)
EI value			95.2544	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.6600 (1b)	x	2.4000 (2b)	=	152.7840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 63.6600						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	152.7840	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			21.8000	1.2357	26.9392			(27)
External Wall 1	42.8700	21.8000	21.0700	0.1400	2.9498	14.0000	294.9800	(29a)
Total net area of external elements Aum(A, m2)			42.8700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.8890			(33)
Party Wall 1			37.5300	0.0000	0.0000	20.0000	750.6000	(32)
Wall to corridor			6.6800	0.0000	0.0000	20.0000	133.6000	(32)
Party Floor 1			63.6600			80.0000	5092.8000	(32d)
Party Ceiling 1			63.6600			80.0000	5092.8000	(32b)
Internal Wall 1			123.2200			9.0000	1108.9800	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12473.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 195.9434 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	9.3800	0.0500	0.4690
E4 Jamb	27.8400	0.0500	1.3920
E7 Party floor between dwellings (in blocks of flats)	15.8700	0.0700	1.1109
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3700	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.7819 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 33.6709 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.4155	15.4155	15.0941	14.1298	13.9691	13.3263	13.0049	13.0049	13.6477	14.4513	14.7727	14.6120	(38)
Heat transfer coeff	49.0864	49.0864	48.7650	47.8007	47.6400	46.9972	46.6757	46.6757	47.3186	48.1221	48.4435	48.2828	(39)
Average = Sum(39)m / 12 =												47.9078	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7711	0.7711	0.7660	0.7509	0.7484	0.7383	0.7332	0.7332	0.7433	0.7559	0.7610	0.7584	(40)
HLP (average)												0.7526	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0830 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	81.3240	80.1018	78.3209	74.9135	72.3989	69.5946	68.0007	69.7681	71.7056	74.7165	78.1971	81.0124	(42a)
Hot water usage for baths	25.5574	25.1778	24.6433	23.6578	22.9198	22.1016	21.6596	22.1903	22.7682	23.6438	24.6497	25.4710	(42b)
Hot water usage for other uses	35.9620	34.6543	33.3466	32.0389	30.7312	29.4235	29.4235	30.7312	32.0389	33.3466	34.6543	35.9620	(42c)
Average daily hot water use (litres/day)												131.3665	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	142.8434	139.9340	136.3109	130.6102	126.0499	121.1197	119.0838	122.6897	126.5127	131.7069	137.5011	142.4454	(44)
Energy conte	226.2290	199.2641	209.5047	178.7988	169.6874	148.9308	144.0215	151.9154	156.0028	178.7250	195.8955	223.0351	(45)
Energy content (annual)										Total = Sum(45)m =		2182.0102	
Distribution loss (46)m = 0.15 x (45)m	33.9344	29.8896	31.4257	26.8198	25.4531	22.3396	21.6032	22.7873	23.4004	26.8088	29.3843	33.4553	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
									Total per year (kWh/year) = Sum(64)m =			2429.0422	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	92.0058	81.4156	86.4450	75.6938	73.2057	65.7627	64.6718	67.2965	68.1141	76.2107	81.3784	90.9438	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	20.9586	18.6152	15.1389	11.4611	8.5673	7.2329	7.8154	10.1588	13.6351	17.3128	20.2066	21.5411	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	271.7527	274.5726	267.4664	252.3383	233.2416	215.2935	203.3031	200.4831	207.5893	222.7175	241.8141	259.7622	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	(71)

Water heating gains (Table 5)

	123.6637	121.1542	116.1895	105.1303	98.3948	91.3371	86.9244	90.4523	94.6030	102.4338	113.0256	122.2363	(72)

Total internal gains

	507.6160	505.5831	490.0359	460.1707	431.4448	405.1046	389.2840	392.3353	407.0684	433.7051	466.2874	494.7806	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1100	9.5462	0.6300	0.8270	0.7700	7.2726	(74)
Northeast	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(75)
Northwest	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(81)

Solar gains	78.5852	169.1438	316.2472	546.8143	731.2676	760.0483	718.8368	554.5515	381.6735	204.7435	101.3144	65.8401	(83)
Total gains	586.2012	674.7269	806.2830	1006.9851	1162.7125	1165.1528	1108.1208	946.8868	788.7419	638.4486	567.6018	560.6207	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.5885	70.5885	71.0537	72.4871	72.7316	73.7264	74.2341	74.2341	73.2256	72.0029	71.5252	71.7632	
alpha	5.7059	5.7059	5.7369	5.8325	5.8488	5.9151	5.9489	5.9489	5.8817	5.8002	5.7683	5.7842	
util living area	0.9573	0.9201	0.8197	0.6065	0.4204	0.3144	0.2569	0.3054	0.4881	0.7768	0.9246	0.9649	(86)
MIT	20.3836	20.5593	20.8002	20.9657	20.9959	20.9994	20.9999	20.9996	20.9932	20.8936	20.6163	20.3459	(87)
Th 2	20.2785	20.2785	20.2829	20.2961	20.2983	20.3072	20.3116	20.3116	20.3027	20.2917	20.2873	20.2895	(88)
util rest of house	0.9492	0.9069	0.7967	0.5771	0.3923	0.2865	0.2279	0.2716	0.4478	0.7427	0.9098	0.9582	(89)
MIT 2	19.5748	19.7882	20.0732	20.2636	20.2949	20.3067	20.3115	20.3114	20.2976	20.1904	19.8693	19.5372	(90)
Living area fraction									fLA = Living area / (4) =			0.3699	(91)
MIT	19.8740	20.0735	20.3421	20.5233	20.5543	20.5630	20.5662	20.5660	20.5549	20.4505	20.1456	19.8364	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8740	20.0735	20.3421	20.5233	20.5543	20.5630	20.5662	20.5660	20.5549	20.4505	20.1456	19.8364	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9440	0.9027	0.7987	0.5867	0.4026	0.2968	0.2386	0.2841	0.4625	0.7507	0.9065	0.9532	(94)
Useful gains	553.3976	609.0788	643.9471	590.8262	468.0629	345.8541	264.4318	269.0226	364.7623	479.2565	514.5178	534.3769	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	784.1055	774.2617	718.8998	603.4044	469.4566	346.0392	264.4719	269.1309	366.9520	517.3378	656.1978	779.1096	(97)
Space heating kWh	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(98a)
Space heating requirement - total per year (kWh/year)												660.9309	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												660.9309	
Space heating per m2											(98c) / (4) =	10.3822	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
Efficiency of water heater												100.0000	(216)

(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.0817	10.0092	11.0817	10.7242	11.0817	10.7242	11.0817	11.0817	10.7242	11.0817	10.7242	11.0817	(231)
Lighting	18.3449	14.7170	13.2510	9.7083	7.4989	6.1267	6.8408	8.8919	11.5497	15.1538	17.1162	18.8548	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-13.8915	-23.5305	-39.5288	-51.3707	-59.7978	-56.3926	-55.9689	-49.3612	-40.0071	-28.3817	-16.4413	-11.9422	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.3070	-6.0873	-15.0525	-27.9982	-39.0374	-38.6728	-38.7444	-30.0375	-20.2557	-9.7595	-3.4566	-1.8147	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	660.9309	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2429.0422	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	130.4775	(230a)
Total electricity for the above, kWh/year	130.4775	(231)
Electricity for lighting (calculated in Appendix L)	148.0540	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-679.8382	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2688.6664	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	660.9309	25.1600	166.2902	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	25.1600	611.1470	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	130.4775	25.1600	32.8281	(249)
Energy for lighting	148.0540	25.1600	37.2504	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.6146	25.1600	-112.3682	
PV Unit electricity exported	-233.2236	5.8100	-13.5503	
Total			-125.9185	(252)
Total energy cost			721.5972	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	660.9309	0.1583	104.6387	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2429.0422	0.1413	343.1917	(264)
Space and water heating			447.8304	(265)
Pumps, fans and electric keep-hot	130.4775	0.1387	18.0988	(267)
Energy for lighting	148.0540	0.1443	21.3688	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.6146	0.1321	-58.9946	
PV Unit electricity exported	-233.2236	0.1224	-28.5364	
Total			-87.5310	(269)
Total CO2, kg/year			399.7670	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	660.9309	1.5860	1048.2442	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	1.5224	3698.0874	(278)
Space and water heating			4746.3316	(279)
Pumps, fans and electric keep-hot	130.4775	1.5128	197.3864	(281)
Energy for lighting	148.0540	1.5338	227.0901	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.6146	1.4881	-664.5888	
PV Unit electricity exported	-233.2236	0.4490	-104.7247	
Total			-769.3135	(283)
Total Primary energy kWh/year			4401.4946	(286)

SAP 10 EPC IMPROVEMENTS

Unit 67 L04_Copy

Current energy efficiency rating: C 76
Current environmental impact rating: A 95

N Solar water heating	Not applicable
U Solar photovoltaic panels	Not applicable
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 76
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£848	£848	£0
Space heating	£199	£199	£0
Water heating	£611	£611	£0
Lighting	£37	£37	£0
Generated (PV)	-£126	-£126	£0
Total cost of fuels	£722	£722	£0
Total cost of uses	£721	£721	£0
Delivered energy	42 kWh/m²	42 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	69 kWh/m²	69 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.6600 (1b)	x	2.4000 (2b)	=	152.7840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.6600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	152.7840	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			21.8000	1.2357	26.9392			(27)
External Wall 1	42.8700	21.8000	21.0700	0.1400	2.9498	14.0000	294.9800	(29a)
Total net area of external elements Aum(A, m2)			42.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.8890			(33)
Party Wall 1			37.5300	0.0000	0.0000	20.0000	750.6000	(32)
Wall to corridor			6.6800	0.0000	0.0000	20.0000	133.6000	(32)
Party Floor 1			63.6600			80.0000	5092.8000	(32d)
Party Ceiling 1			63.6600			80.0000	5092.8000	(32b)
Internal Wall 1			123.2200			9.0000	1108.9800	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12473.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 195.9434 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	9.3800	0.0500	0.4690
E4 Jamb	27.8400	0.0500	1.3920
E7 Party floor between dwellings (in blocks of flats)	15.8700	0.0700	1.1109
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3700	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.7819 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 33.6709 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.2548	15.0941	14.9334	14.1298	13.9691	13.1656	13.1656	13.0049	13.4870	13.9691	14.2906	14.6120	(38)
Heat transfer coeff	48.9257	48.7650	48.6043	47.8007	47.6400	46.8365	46.8365	46.6757	47.1579	47.6400	47.9614	48.2828	(39)

Average = Sum(39)m / 12 = 47.7605

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7685	0.7660	0.7635	0.7509	0.7484	0.7357	0.7357	0.7332	0.7408	0.7484	0.7534	0.7584	(40)
HLP (average)												0.7502	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0830 (42)
Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
81.3240	80.1018	78.3209	74.9135	72.3989	69.5946	68.0007	69.7681	71.7056	74.7165	78.1971	81.0124	(42a)

Hot water usage for baths

25.5574	25.1778	24.6433	23.6578	22.9198	22.1016	21.6596	22.1903	22.7682	23.6438	24.6497	25.4710	(42b)

Hot water usage for other uses

35.9620	34.6543	33.3466	32.0389	30.7312	29.4235	29.4235	30.7312	32.0389	33.3466	34.6543	35.9620	(42c)

Average daily hot water use (litres/day) 131.3665 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	142.8434	139.9340	136.3109	130.6102	126.0499	121.1197	119.0838	122.6897	126.5127	131.7069	137.5011	142.4454	(44)
Energy conte	226.2290	199.2641	209.5047	178.7988	169.6874	148.9308	144.0215	151.9154	156.0028	178.7250	195.8955	223.0351	(45)
Energy content (annual)										Total = Sum(45)m =		2182.0102	
Distribution loss (46)m = 0.15 x (45)m	33.9344	29.8896	31.4257	26.8198	25.4531	22.3396	21.6032	22.7873	23.4004	26.8088	29.3843	33.4553	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
										Total per year (kWh/year) = Sum(64)m =		2429.0422	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	92.0058	81.4156	86.4450	75.6938	73.2057	65.7627	64.6718	67.2965	68.1141	76.2107	81.3784	90.9438	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.9586	18.6152	15.1389	11.4611	8.5673	7.2329	7.8154	10.1588	13.6351	17.3128	20.2066	21.5411	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	271.7527	274.5726	267.4664	252.3383	233.2416	215.2935	203.3031	200.4831	207.5893	222.7175	241.8141	259.7622	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	(71)
Water heating gains (Table 5)	123.6637	121.1542	116.1895	105.1303	98.3948	91.3371	86.9244	90.4523	94.6030	102.4338	113.0256	122.2363	(72)

Total internal gains

	507.6160	505.5831	490.0359	460.1707	431.4448	405.1046	389.2840	392.3353	407.0684	433.7051	466.2874	494.7806 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1100	10.6334	0.6300	0.8270	0.7700	8.1009	(74)
Northeast	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(75)
Northwest	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(81)

Solar gains	88.3144	178.7581	320.4794	525.3714	706.3245	753.2685	704.5544	561.4605	390.0832	217.9657	110.9228	72.2597 (83)
Total gains	595.9304	684.3412	810.5153	985.5421	1137.7693	1158.3731	1093.8384	953.7958	797.1516	651.6708	577.2102	567.0403 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.8203	71.0537	71.2887	72.4871	72.7316	73.9794	73.9794	74.2341	73.4752	72.7316	72.2442	71.7632	
alpha	5.7214	5.7369	5.7526	5.8325	5.8488	5.9320	5.9320	5.9489	5.8983	5.8488	5.8163	5.7842	
util living area	0.9495	0.9033	0.7864	0.5758	0.3884	0.2587	0.1884	0.2251	0.4070	0.7170	0.9072	0.9584	(86)
MIT	20.4430	20.6297	20.8505	20.9756	20.9976	20.9998	21.0000	20.9999	20.9978	20.9371	20.6818	20.4051	(87)
Th 2	20.2807	20.2829	20.2851	20.2961	20.2983	20.3094	20.3094	20.3116	20.3050	20.2983	20.2939	20.2895	(88)
util rest of house	0.9400	0.8877	0.7604	0.5448	0.3594	0.2308	0.1588	0.1914	0.3664	0.6785	0.8895	0.9504	(89)
MIT 2	19.6501	19.8768	20.1321	20.2738	20.2964	20.3093	20.3094	20.3116	20.3035	20.2415	19.9531	19.6111	(90)
Living area fraction									fLA = Living area / (4) =			0.3699	(91)
MIT	19.9434	20.1553	20.3979	20.5334	20.5558	20.5647	20.5649	20.5662	20.5604	20.4988	20.2227	19.9048	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9434	20.1553	20.3979	20.5334	20.5558	20.5647	20.5649	20.5662	20.5604	20.4988	20.2227	19.9048	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9350	0.8847	0.7647	0.5553	0.3701	0.2411	0.1698	0.2039	0.3814	0.6898	0.8875	0.9454	(94)
Useful gains	557.2083	605.4138	619.7693	547.3032	421.0875	279.3214	185.6954	194.4496	304.0092	449.5203	512.2933	536.1066	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	765.3659	743.9254	675.4971	556.0856	421.8901	279.3673	185.6996	194.4617	304.6569	471.5806	629.3813	758.2722	(97)
Space heating kWh	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(98a)
Space heating requirement - total per year (kWh/year)												562.3385	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												562.3385	
Space heating per m2											(98c) / (4) =	8.8335	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.0817	10.0092	11.0817	10.7242	11.0817	10.7242	11.0817	11.0817	10.7242	11.0817	10.7242	11.0817	(231)
Lighting	18.3449	14.7170	13.2510	9.7083	7.4989	6.1267	6.8408	8.8919	11.5497	15.1538	17.1162	18.8548	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.3302	-24.3862	-39.3596	-49.2100	-57.7415	-55.5822	-54.6983	-49.3462	-40.2733	-29.5092	-17.6479	-12.9166	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													

(233b)m	-2.7432	-6.5971	-15.2405	-26.0425	-36.6010	-37.6280	-37.0950	-30.0206	-20.4973	-10.6316	-3.9607	-2.0877	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	562.3385	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2429.0422	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	130.4775	(230a)
Total electricity for the above, kWh/year	130.4775	(231)
Electricity for lighting (calculated in Appendix L)	148.0540	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-675.1465	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2594.7657	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	562.3385	16.4900	92.7296	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	16.4900	400.5491	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	130.4775	16.4900	21.5157	(249)
Energy for lighting	148.0540	16.4900	24.4141	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.0013	16.4900	-73.5456	
PV Unit electricity exported	-229.1452	5.5900	-12.8092	
Total			-86.3548	(252)
Total energy cost			452.8537	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.5003	(257)
SAP value		75.6794	
SAP rating (Section 12)		76	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	562.3385	0.1589	89.3676	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2429.0422	0.1413	343.1917	(264)
Space and water heating			432.5592	(265)
Pumps, fans and electric keep-hot	130.4775	0.1387	18.0988	(267)
Energy for lighting	148.0540	0.1443	21.3688	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.0013	0.1324	-59.0465	
PV Unit electricity exported	-229.1452	0.1229	-28.1599	
Total			-87.2065	(269)
Total CO2, kg/year			384.8203	(272)
CO2 emissions per m2			6.0400	(273)
EI value			95.2544	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		63.6600 (1b)	x	2.4000 (2b)	=	152.7840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.6600						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	152.7840	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			21.8000	1.2357	26.9392			(27)
External Wall 1	42.8700	21.8000	21.0700	0.1400	2.9498	14.0000	294.9800	(29a)
Total net area of external elements Aum(A, m2)			42.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.8890			(33)
Party Wall 1			37.5300	0.0000	0.0000	20.0000	750.6000	(32)
Wall to corridor			6.6800	0.0000	0.0000	20.0000	133.6000	(32)
Party Floor 1			63.6600			80.0000	5092.8000	(32d)
Party Ceiling 1			63.6600			80.0000	5092.8000	(32b)
Internal Wall 1			123.2200			9.0000	1108.9800	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12473.7600	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	195.9434	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	9.3800	0.0500	0.4690
E4 Jamb	27.8400	0.0500	1.3920
E7 Party floor between dwellings (in blocks of flats)	15.8700	0.0700	1.1109
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3700	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	3.7819	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	33.6709	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.4155	15.4155	15.0941	14.1298	13.9691	13.3263	13.0049	13.0049	13.6477	14.4513	14.7727	14.6120	(38)
Heat transfer coeff	49.0864	49.0864	48.7650	47.8007	47.6400	46.9972	46.6757	46.6757	47.3186	48.1221	48.4435	48.2828	(39)
Average = Sum(39)m / 12 =												47.9078	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7711	0.7711	0.7660	0.7509	0.7484	0.7383	0.7332	0.7332	0.7433	0.7559	0.7610	0.7584	(40)
HLP (average)												0.7526	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0830	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
81.3240	80.1018	78.3209	74.9135	72.3989	69.5946	68.0007	69.7681	71.7056	74.7165	78.1971	81.0124	(42a)

Hot water usage for baths

25.5574	25.1778	24.6433	23.6578	22.9198	22.1016	21.6596	22.1903	22.7682	23.6438	24.6497	25.4710	(42b)

Hot water usage for other uses

35.9620	34.6543	33.3466	32.0389	30.7312	29.4235	29.4235	30.7312	32.0389	33.3466	34.6543	35.9620	(42c)

Average daily hot water use (litres/day)	131.3665	(43)

Daily hot water use

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
142.8434	139.9340	136.3109	130.6102	126.0499	121.1197	119.0838	122.6897	126.5127	131.7069	137.5011	142.4454	(44)
Energy conte 226.2290	199.2641	209.5047	178.7988	169.6874	148.9308	144.0215	151.9154	156.0028	178.7250	195.8955	223.0351	(45)
Energy content (annual)										Total = Sum(45)m =		2182.0102	

Distribution loss (46)m = 0.15 x (45)m

33.9344	29.8896	31.4257	26.8198	25.4531	22.3396	21.6032	22.7873	23.4004	26.8088	29.3843	33.4553	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

Total storage loss													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
											Total per year (kWh/year) = Sum(64)m =	2429.0422	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000	(64a)
Heat gains from water heating, kWh/month													
	92.0058	81.4156	86.4450	75.6938	73.2057	65.7627	64.6718	67.2965	68.1141	76.2107	81.3784	90.9438	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.9586	18.6152	15.1389	11.4611	8.5673	7.2329	7.8154	10.1588	13.6351	17.3128	20.2066	21.5411	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	271.7527	274.5726	267.4664	252.3383	233.2416	215.2935	203.3031	200.4831	207.5893	222.7175	241.8141	259.7622	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	(71)
Water heating gains (Table 5)													
	123.6637	121.1542	116.1895	105.1303	98.3948	91.3371	86.9244	90.4523	94.6030	102.4338	113.0256	122.2363	(72)
Total internal gains													
	507.6160	505.5831	490.0359	460.1707	431.4448	405.1046	389.2840	392.3353	407.0684	433.7051	466.2874	494.7806	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1100	9.5462	0.6300	0.8270	0.7700	7.2726	(74)
Northeast	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(75)
Northwest	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(81)

Solar gains	78.5852	169.1438	316.2472	546.8143	731.2676	760.0483	718.8368	554.5515	381.6735	204.7435	101.3144	65.8401	(83)
Total gains	586.2012	674.7269	806.2830	1006.9851	1162.7125	1165.1528	1108.1208	946.8868	788.7419	638.4486	567.6018	560.6207	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.5885	70.5885	71.0537	72.4871	72.7316	73.7264	74.2341	74.2341	73.2256	72.0029	71.5252	71.7632	
alpha	5.7059	5.7059	5.7369	5.8325	5.8488	5.9151	5.9489	5.9489	5.8817	5.8002	5.7683	5.7842	
util living area													
	0.9573	0.9201	0.8197	0.6065	0.4204	0.3144	0.2569	0.3054	0.4881	0.7768	0.9246	0.9649	(86)
MIT	20.3836	20.5593	20.8002	20.9657	20.9959	20.9994	20.9999	20.9996	20.9932	20.8936	20.6163	20.3459	(87)
Th 2	20.2785	20.2785	20.2829	20.2961	20.2983	20.3072	20.3116	20.3116	20.3027	20.2917	20.2873	20.2895	(88)
util rest of house													
	0.9492	0.9069	0.7967	0.5771	0.3923	0.2865	0.2279	0.2716	0.4478	0.7427	0.9098	0.9582	(89)
MIT 2	19.5748	19.7882	20.0732	20.2636	20.2949	20.3067	20.3115	20.3114	20.2976	20.1904	19.8693	19.5372	(90)
Living area fraction										fLA = Living area / (4) =		0.3699	(91)
MIT	19.8740	20.0735	20.3421	20.5233	20.5543	20.5630	20.5662	20.5660	20.5549	20.4505	20.1456	19.8364	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8740	20.0735	20.3421	20.5233	20.5543	20.5630	20.5662	20.5660	20.5549	20.4505	20.1456	19.8364	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9440	0.9027	0.7987	0.5867	0.4026	0.2968	0.2386	0.2841	0.4625	0.7507	0.9065	0.9532	(94)
Useful gains	553.3976	609.0788	643.9471	590.8262	468.0629	345.8541	264.4318	269.0226	364.7623	479.2565	514.5178	534.3769	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	784.1055	774.2617	718.8998	603.4044	469.4566	346.0392	264.4719	269.1309	366.9520	517.3378	656.1978	779.1096	(97)
Space heating kWh													
	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(98a)
Space heating requirement - total per year (kWh/year)												660.9309	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												660.9309	
Space heating per m2											(98c) / (4) =	10.3822	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.0817	10.0092	11.0817	10.7242	11.0817	10.7242	11.0817	11.0817	10.7242	11.0817	10.7242	11.0817	(231)
Lighting	18.3449	14.7170	13.2510	9.7083	7.4989	6.1267	6.8408	8.8919	11.5497	15.1538	17.1162	18.8548	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-13.8915	-23.5305	-39.5288	-51.3707	-59.7978	-56.3926	-55.9689	-49.3612	-40.0071	-28.3817	-16.4413	-11.9422	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.3070	-6.0873	-15.0525	-27.9982	-39.0374	-38.6728	-38.7444	-30.0375	-20.2557	-9.7595	-3.4566	-1.8147	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												660.9309	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2429.0422	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)													
mechanical ventilation fans (SFP = 0.7000)												130.4775	(230a)
Total electricity for the above, kWh/year												130.4775	(231)
Electricity for lighting (calculated in Appendix L)												148.0540	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-679.8382	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2688.6664	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	660.9309	25.1600	166.2902	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	25.1600	611.1470	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	130.4775	25.1600	32.8281	(249)
Energy for lighting	148.0540	25.1600	37.2504	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.6146	25.1600	-112.3682	
PV Unit electricity exported	-233.2236	5.8100	-13.5503	
Total			-125.9185	(252)
Total energy cost			721.5972	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	660.9309	0.1583	104.6387	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2429.0422	0.1413	343.1917	(264)
Space and water heating			447.8304	(265)
Pumps, fans and electric keep-hot	130.4775	0.1387	18.0988	(267)
Energy for lighting	148.0540	0.1443	21.3688	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.6146	0.1321	-58.9946	
PV Unit electricity exported	-233.2236	0.1224	-28.5364	
Total			-87.5310	(269)
Total CO2, kg/year			399.7670	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	660.9309	1.5860	1048.2442	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	1.5224	3698.0874	(278)
Space and water heating			4746.3316	(279)
Pumps, fans and electric keep-hot	130.4775	1.5128	197.3864	(281)
Energy for lighting	148.0540	1.5338	227.0901	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.6146	1.4881	-664.5888	
PV Unit electricity exported	-233.2236	0.4490	-104.7247	
Total			-769.3135	(283)
Total Primary energy kWh/year			4401.4946	(286)

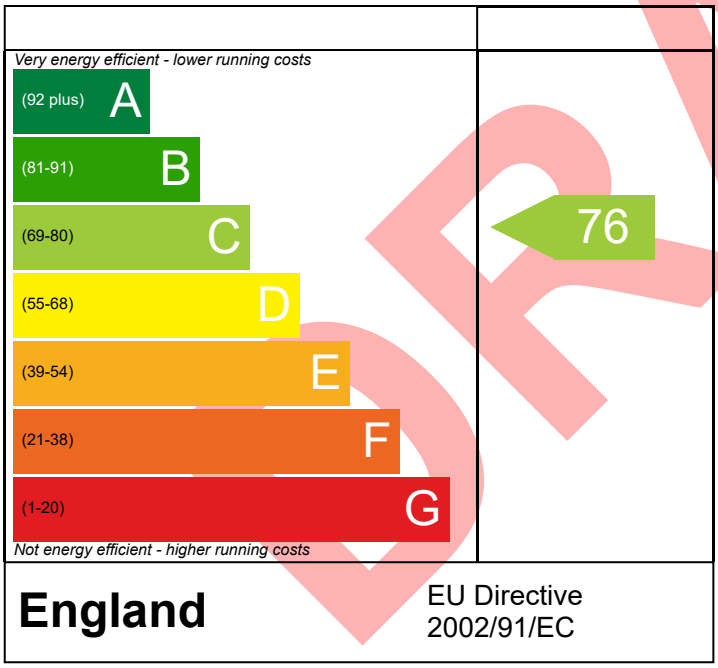
Predicted Energy Assessment

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	63.66 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

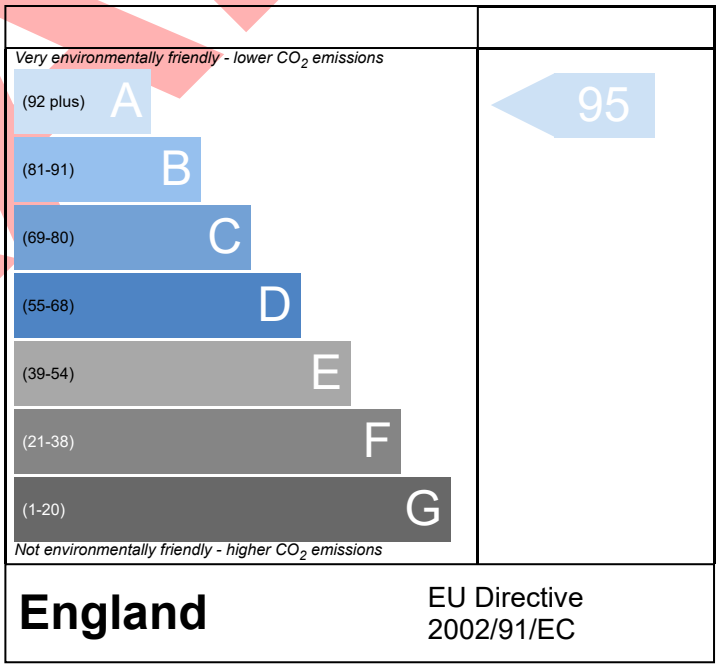
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:41

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	72 m^2
Site Reference	Unit 68 L04_Copy	Plot Reference	Unit 68 L04_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*10.45 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	4.68 kgCO_2/m^2	**OK**
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*56.41 kWh$_{PE}$/m^2*	
Dwelling primary energy	52.87 kWh$_{PE}$/m^2	**OK**
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*18.9 kWh/m^2*	
Dwelling fabric energy efficiency	17.8 kWh/m^2	**OK**

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	**OK**
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	**OK**
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	16.81	0.14 **(!)**
Party wall: Party Wall (1)	41.71	0 **(!)**
Party wall: Party Wall (2)	22.81	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	11.81	North East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.93 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 68 L04_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 68 L04_Copy	**Prop Type Ref**	Unit 68 L04
Property			

SAP Rating	80 C	**DER**	4.68	**TER**	10.45
Environmental	96 A	**% DER < TER**			55.22
CO_2 Emissions (t/year)	0.33	**DFEE**	17.78	**TFEE**	18.90
Compliance Check	See BREL	**% DFEE < TFEE**			5.90
% DPER < TPER	6.27	**DPER**	52.87	**TPER**	56.41

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	71.6800 (1b)	x	2.4000 (2b)	=	172.0320	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.6800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	172.0320	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	28.6200	11.8100	16.8100	0.1400	2.3534	14.0000	235.3400	(29a)
Total net area of external elements Aum(A, m2)			28.6200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.9475			(33)
Party Wall 1			41.7100	0.0000	0.0000	20.0000	834.2000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			71.6800			80.0000	5734.4000	(32d)
Party Ceiling 1			71.6800			80.0000	5734.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14231.4100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		198.5409 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545

E4 Jamb	13.9200	0.0500	0.6960	
E7 Party floor between dwellings (in blocks of flats)	10.6000	0.0700	0.7420	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.9000	0.0000	0.0000	
E16 Corner (normal)	2.7000	0.0900	0.2430	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.2595 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 19.2070 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3623	16.1974	16.0324	15.2074	15.0424	14.2175	14.2175	14.0525	14.5475	15.0424	15.3724	15.7024	(38)
Heat transfer coeff	35.5693	35.4044	35.2394	34.4144	34.2494	33.4245	33.4245	33.2595	33.7545	34.2494	34.5794	34.9094	(39)
Average = Sum(39)m / 12 =												34.3732	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4962	0.4939	0.4916	0.4801	0.4778	0.4663	0.4663	0.4640	0.4709	0.4778	0.4824	0.4870	(40)
HLP (average)												0.4795	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2862 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	86.0089	84.7163	82.8328	79.2291	76.5696	73.6038	71.9181	73.7873	75.8363	79.0207	82.7018	85.6793	(42a)
Hot water usage for baths	27.0226	26.6213	26.0561	25.0141	24.2338	23.3686	22.9013	23.4625	24.0735	24.9993	26.0628	26.9312	(42b)
Hot water usage for other uses	38.0431	36.6597	35.2763	33.8929	32.5095	31.1262	31.1262	32.5095	33.8929	35.2763	36.6597	38.0431	(42c)
Average daily hot water use (litres/day)												138.9361	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.0745	147.9973	144.1652	138.1361	133.3130	128.0986	125.9455	129.7594	133.8028	139.2963	145.4243	150.6536	(44)
Energy conte	239.2651	210.7461	221.5766	189.1014	179.4649	157.5122	152.3202	160.6692	164.9922	189.0238	207.1836	235.8872	(45)
Energy content (annual)										Total = Sum(45)m =		2307.7426	
Distribution loss (46)m = 0.15 x (45)m	35.8898	31.6119	33.2365	28.3652	26.9197	23.6268	22.8480	24.1004	24.7488	28.3536	31.0775	35.3831	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)
										Total per year (kWh/year) = Sum(64)m =		2554.7746	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	96.3403	85.2334	90.4589	79.1194	76.4567	68.6160	67.4311	70.2071	71.1031	79.6351	85.1318	95.2171	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.3930	20.7775	16.8974	12.7924	9.5625	8.0730	8.7232	11.3387	15.2188	19.3238	22.5537	24.0432	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	300.2774	303.3934	295.5413	278.8252	257.7241	237.8920	224.6430	221.5270	229.3791	246.0952	267.1963	287.0284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	(71)
Water heating gains (Table 5)	129.4896	126.8354	121.5845	109.8881	102.7644	95.3000	90.6332	94.3644	98.7543	107.0364	118.2386	127.9800	(72)
Total internal gains	549.8877	547.7339	530.7508	498.2333	466.7786	437.9927	420.7271	423.9579	440.0799	469.1831	504.7163	535.7792	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(75)

Solar gains	48.1118	97.9329	176.4440	289.7718	389.5101	415.2590	388.4663	309.6898	214.9998	119.6818	60.5371	39.2905	(83)
Total gains	597.9995	645.6669	707.1948	788.0051	856.2887	853.2517	809.1933	733.6477	655.0797	588.8649	565.2534	575.0697	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	111.1398	111.6577	112.1805	114.8696	115.4229	118.2717	118.2717	118.8584	117.1155	115.4229	114.3215	113.2409	
alpha	8.4093	8.4438	8.4787	8.6580	8.6949	8.8848	8.8848	8.9239	8.8077	8.6949	8.6214	8.5494	
util living area													
	0.8907	0.8306	0.7092	0.5274	0.3719	0.2507	0.1817	0.2085	0.3555	0.6018	0.8105	0.9039	(86)
MIT	20.8722	20.9298	20.9803	20.9984	20.9999	21.0000	21.0000	21.0000	21.0000	20.9963	20.9530	20.8608	(87)
Th 2	20.5243	20.5264	20.5285	20.5391	20.5412	20.5518	20.5518	20.5539	20.5476	20.5412	20.5370	20.5327	(88)
util rest of house													
	0.8771	0.8135	0.6886	0.5076	0.3536	0.2332	0.1632	0.1883	0.3322	0.5761	0.7902	0.8914	(89)
MIT 2	20.3839	20.4516	20.5087	20.5376	20.5412	20.5518	20.5518	20.5539	20.5476	20.5379	20.4887	20.3786	(90)
Living area fraction										fLA = Living area / (4) =		0.4021	(91)
MIT	20.5802	20.6438	20.6983	20.7228	20.7256	20.7320	20.7320	20.7333	20.7295	20.7222	20.6754	20.5725	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5802	20.6438	20.6983	20.7228	20.7256	20.7320	20.7320	20.7333	20.7295	20.7222	20.6754	20.5725	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8788	0.8178	0.6961	0.5155	0.3610	0.2402	0.1707	0.1964	0.3416	0.5863	0.7964	0.8925	(94)
Useful gains	525.5185	528.0545	492.2508	406.2317	309.0939	204.9590	138.1105	144.1228	223.7621	345.2470	450.1599	513.2582	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	579.0763	557.4003	500.3404	406.8764	309.1219	204.9594	138.1105	144.1229	223.7735	346.6793	469.4288	571.5536	(97)
Space heating kWh	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(98a)
Space heating requirement - total per year (kWh/year)												124.3821	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												124.3821	
Space heating per m2											(98c) / (4) =	1.7352	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.2264	11.9464	13.2264	12.7997	13.2264	12.7997	13.2264	13.2264	12.7997	13.2264	12.7997	13.2264	(231)
Lighting	20.4758	16.4264	14.7902	10.8359	8.3700	6.8383	7.6354	9.9247	12.8912	16.9140	19.1043	21.0448	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-17.0008	-26.9528	-43.7049	-55.0326	-64.6365	-62.1981	-61.2076	-55.2744	-45.1885	-33.0016	-19.5873	-14.3353	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.4971	-8.1867	-18.2196	-30.3147	-42.3617	-43.5158	-42.8995	-34.7392	-23.7344	-12.5240	-4.9201	-2.6818	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												124.3821	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2554.7746	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)													
mechanical ventilation fans (SFP = 0.7420)												155.7302	(230a)
Total electricity for the above, kWh/year												155.7302	(231)
Electricity for lighting (calculated in Appendix L)												165.2510	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-765.7149	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)

Appendix Q - special features

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2234.4231	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	124.3821	16.4900	20.5106	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	16.4900	421.2823	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	155.7302	16.4900	25.6799	(249)
Energy for lighting	165.2510	16.4900	27.2499	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.1204	16.4900	-82.1401	
PV Unit electricity exported	-267.5945	5.5900	-14.9585	
Total			-97.0986	(252)
Total energy cost			397.6242	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2268	(257)
SAP value	80.1133	
SAP rating (Section 12)	80	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	124.3821	0.1604	19.9497	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2554.7746	0.1413	360.9927	(264)
Space and water heating			380.9424	(265)
Pumps, fans and electric keep-hot	155.7302	0.1387	21.6017	(267)
Energy for lighting	165.2510	0.1443	23.8508	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.1204	0.1323	-65.9162	
PV Unit electricity exported	-267.5945	0.1234	-33.0212	
Total			-98.9374	(269)
Total CO2, kg/year			327.4575	(272)
CO2 emissions per m2			4.5700	(273)
EI value			96.2393	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	71.6800	(1b)	x 2.4000	(2b) =	172.0320	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 71.6800						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		172.0320	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 = 0.0000	(6a)
Number of open flues	0 * 20 = 0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000	(6d)
Number of flues attached to other heater	0 * 35 = 0.0000	(6e)
Number of blocked chimneys	0 * 20 = 0.0000	(6f)
Number of intermittent extract fans	0 * 10 = 0.0000	(7a)
Number of passive vents	0 * 10 = 0.0000	(7b)
Number of flueless gas fires	0 * 40 = 0.0000	(7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000	(8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	3.0000	(17)
Infiltration rate	0.1500	(18)
Number of sides sheltered	3	(19)
Shelter factor (20) = 1 - [0.075 x (19)] =	0.7750	(20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	28.6200	11.8100	16.8100	0.1400	2.3534	14.0000	235.3400	(29a)
Total net area of external elements Aum(A, m2)			28.6200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.9475			(33)
Party Wall 1			41.7100	0.0000	0.0000	20.0000	834.2000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			71.6800			80.0000	5734.4000	(32d)
Party Ceiling 1			71.6800			80.0000	5734.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14231.4100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 198.5409 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	10.6000	0.0700	0.7420
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.9000	0.0000	0.0000
E16 Corner (normal)	2.7000	0.0900	0.2430

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 0.2595 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 19.2070 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.5273	16.5273	16.1974	15.2074	15.0424	14.3825	14.0525	14.0525	14.7124	15.5374	15.8674	15.7024	(38)
Heat transfer coeff	35.7343	35.7343	35.4044	34.4144	34.2494	33.5895	33.2595	33.2595	33.9195	34.7444	35.0744	34.9094	(39)

Average = Sum(39)m / 12 = 34.5244

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4985	0.4985	0.4939	0.4801	0.4778	0.4686	0.4640	0.4640	0.4732	0.4847	0.4893	0.4870	(40)
HLP (average)												0.4816	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2862 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	86.0089	84.7163	82.8328	79.2291	76.5696	73.6038	71.9181	73.7873	75.8363	79.0207	82.7018	85.6793	(42a)
Hot water usage for baths	27.0226	26.6213	26.0561	25.0141	24.2338	23.3686	22.9013	23.4625	24.0735	24.9993	26.0628	26.9312	(42b)
Hot water usage for other uses	38.0431	36.6597	35.2763	33.8929	32.5095	31.1262	31.1262	32.5095	33.8929	35.2763	36.6597	38.0431	(42c)

Average daily hot water use (litres/day) 138.9361 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.0745	147.9973	144.1652	138.1361	133.3130	128.0986	125.9455	129.7594	133.8028	139.2963	145.4243	150.6536	(44)
Energy conte	239.2651	210.7461	221.5766	189.1014	179.4649	157.5122	152.3202	160.6692	164.9922	189.0238	207.1836	235.8872	(45)

Energy content (annual) Total = Sum(45)m = 2307.7426

Distribution loss (46)m = 0.15 x (45)m	35.8898	31.6119	33.2365	28.3652	26.9197	23.6268	22.8480	24.1004	24.7488	28.3536	31.0775	35.3831	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)

Total per year (kWh/year) = Sum(64)m = 2554.7746 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	96.3403	85.2334	90.4589	79.1194	76.4567	68.6160	67.4311	70.2071	71.1031	79.6351	85.1318	95.2171	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.3930	20.7775	16.8974	12.7924	9.5625	8.0730	8.7232	11.3387	15.2188	19.3238	22.5537	24.0432	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	300.2774	303.3934	295.5413	278.8252	257.7241	237.8920	224.6430	221.5270	229.3791	246.0952	267.1963	287.0284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	(71)
Water heating gains (Table 5)													
	129.4896	126.8354	121.5845	109.8881	102.7644	95.3000	90.6332	94.3644	98.7543	107.0364	118.2386	127.9800	(72)
Total internal gains													
	549.8877	547.7339	530.7508	498.2333	466.7786	437.9927	420.7271	423.9579	440.0799	469.1831	504.7163	535.7792	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(75)

Solar gains	42.7730	92.6022	174.0550	301.5827	403.2921	419.0362	396.3745	305.8819	210.3213	112.3593	55.2465	35.7661	(83)
Total gains	592.6608	640.3361	704.8058	799.8160	870.0707	857.0289	817.1015	729.8397	650.4012	581.5423	559.9628	571.5453	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	110.6266	110.6266	111.6577	114.8696	115.4229	117.6907	118.8584	118.8584	116.5458	113.7786	112.7082	113.2409	
alpha	8.3751	8.3751	8.4438	8.6580	8.6949	8.8460	8.9239	8.9239	8.7697	8.5852	8.5139	8.5494	
util living area													
	0.9065	0.8593	0.7516	0.5619	0.4054	0.3057	0.2483	0.2825	0.4275	0.6674	0.8432	0.9182	(86)
MIT	20.8464	20.9031	20.9677	20.9971	20.9998	21.0000	21.0000	21.0000	20.9998	20.9906	20.9314	20.8348	(87)
Th 2	20.5222	20.5222	20.5264	20.5391	20.5412	20.5497	20.5539	20.5539	20.5455	20.5349	20.5306	20.5327	(88)
util rest of house													
	0.8943	0.8439	0.7321	0.5426	0.3873	0.2881	0.2301	0.2622	0.4039	0.6418	0.8246	0.9073	(89)
MIT 2	20.3514	20.4171	20.4931	20.5364	20.5411	20.5497	20.5539	20.5539	20.5453	20.5262	20.4588	20.3477	(90)
Living area fraction									fLA = Living area / (4) =			0.4021	(91)
MIT	20.5504	20.6125	20.6839	20.7216	20.7255	20.7307	20.7333	20.7333	20.7280	20.7130	20.6488	20.5436	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5504	20.6125	20.6839	20.7216	20.7255	20.7307	20.7333	20.7333	20.7280	20.7130	20.6488	20.5436	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8951	0.8469	0.7387	0.5502	0.3946	0.2951	0.2374	0.2704	0.4134	0.6517	0.8294	0.9075	(94)
Useful gains	530.4783	542.2746	520.6325	440.0970	343.3043	252.9499	194.0117	197.3368	268.8466	378.9737	464.4567	518.6920	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	594.9914	582.9178	534.0374	441.2484	343.3684	252.9535	194.0121	197.3380	268.9149	382.6385	492.7526	587.9989	(97)
Space heating kWh													
	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643	(98a)
Space heating requirement - total per year (kWh/year)												160.8238	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												160.8238	
Space heating per m2										(98c) / (4) =		2.2436	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(219)
Space cooling fuel requirement													

(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.2264	11.9464	13.2264	12.7997	13.2264	12.7997	13.2264	13.2264	12.7997	13.2264	12.7997	13.2264	(231)
Lighting	20.4758	16.4264	14.7902	10.8359	8.3700	6.8383	7.6354	9.9247	12.8912	16.9140	19.1043	21.0448	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.4126	-25.9729	-43.7522	-57.3553	-66.8995	-63.0965	-62.6159	-55.2911	-44.8919	-31.6377	-18.2309	-13.2576	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.9589	-7.6180	-18.1511	-32.6607	-45.1941	-44.7217	-44.8029	-34.7587	-23.4550	-11.6200	-4.3363	-2.3448	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	160.8238	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2554.7746	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	155.7302	(230a)
Total electricity for the above, kWh/year	155.7302	(231)
Electricity for lighting (calculated in Appendix L)	165.2510	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-771.0360	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2265.5437	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	160.8238	25.1600	40.4633	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	25.1600	642.7813	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	155.7302	25.1600	39.1817	(249)
Energy for lighting	165.2510	25.1600	41.5772	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.4140	25.1600	-125.4010	
PV Unit electricity exported	-272.6220	5.8100	-15.8393	
Total			-141.2403	(252)
Total energy cost			622.7632	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	160.8238	0.1598	25.6965	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2554.7746	0.1413	360.9927	(264)
Space and water heating			386.6891	(265)
Pumps, fans and electric keep-hot	155.7302	0.1387	21.6017	(267)
Energy for lighting	165.2510	0.1443	23.8508	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.4140	0.1320	-65.8025	
PV Unit electricity exported	-272.6220	0.1229	-33.5042	
Total			-99.3067	(269)
Total CO2, kg/year			332.8350	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	160.8238	1.5914	255.9292	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	1.5225	3889.6458	(278)
Space and water heating			4145.5750	(279)
Pumps, fans and electric keep-hot	155.7302	1.5128	235.5887	(281)
Energy for lighting	165.2510	1.5338	253.4676	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.4140	1.4878	-741.5395	
PV Unit electricity exported	-272.6220	0.4510	-122.9601	
Total			-864.4997	(283)
Total Primary energy kWh/year			3770.1316	(286)

SAP 10 EPC IMPROVEMENTS

Unit 68 L04_Copy

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N Solar water heating: Not applicable
U Solar photovoltaic panels: Not applicable
V2 Wind turbine: Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 80
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£764	£764	£0
Space heating	£80	£80	£0
Water heating	£643	£643	£0
Lighting	£42	£42	£0
Generated (PV)	-£141	-£141	£0
Total cost of fuels	£623	£623	£0
Total cost of uses	£624	£624	£0
Delivered energy	32 kWh/m²	32 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	53 kWh/m²	53 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	71.6800 (1b)	x	2.4000 (2b)	=	172.0320	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.6800					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	172.0320	(5)

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2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	28.6200	11.8100	16.8100	0.1400	2.3534	14.0000	235.3400	(29a)
Total net area of external elements Aum(A, m2)			28.6200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.9475			(33)
Party Wall 1			41.7100	0.0000	0.0000	20.0000	834.2000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			71.6800			80.0000	5734.4000	(32d)
Party Ceiling 1			71.6800			80.0000	5734.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14231.4100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 198.5409 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	10.6000	0.0700	0.7420
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.9000	0.0000	0.0000
E16 Corner (normal)	2.7000	0.0900	0.2430

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.2595 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 19.2070 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3623	16.1974	16.0324	15.2074	15.0424	14.2175	14.2175	14.0525	14.5475	15.0424	15.3724	15.7024	(38)
Heat transfer coeff	35.5693	35.4044	35.2394	34.4144	34.2494	33.4245	33.4245	33.2595	33.7545	34.2494	34.5794	34.9094	(39)
Average = Sum(39)m / 12 =												34.3732	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4962	0.4939	0.4916	0.4801	0.4778	0.4663	0.4663	0.4640	0.4709	0.4778	0.4824	0.4870	(40)
HLP (average)												0.4795	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2862 (42)
Hot water usage for mixer showers

86.0089	84.7163	82.8328	79.2291	76.5696	73.6038	71.9181	73.7873	75.8363	79.0207	82.7018	85.6793	(42a)

Hot water usage for baths

27.0226	26.6213	26.0561	25.0141	24.2338	23.3686	22.9013	23.4625	24.0735	24.9993	26.0628	26.9312	(42b)

Hot water usage for other uses

38.0431	36.6597	35.2763	33.8929	32.5095	31.1262	31.1262	32.5095	33.8929	35.2763	36.6597	38.0431	(42c)

Average daily hot water use (litres/day) 138.9361 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.0745	147.9973	144.1652	138.1361	133.3130	128.0986	125.9455	129.7594	133.8028	139.2963	145.4243	150.6536	(44)
Energy conte	239.2651	210.7461	221.5766	189.1014	179.4649	157.5122	152.3202	160.6692	164.9922	189.0238	207.1836	235.8872	(45)
Energy content (annual)										Total = Sum(45)m =		2307.7426	
Distribution loss (46)m = 0.15 x (45)m	35.8898	31.6119	33.2365	28.3652	26.9197	23.6268	22.8480	24.1004	24.7488	28.3536	31.0775	35.3831	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)

Total per year (kWh/year) = Sum(64)m = 2554.7746 (64)
Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month

96.3403	85.2334	90.4589	79.1194	76.4567	68.6160	67.4311	70.2071	71.1031	79.6351	85.1318	95.2171	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.3930	20.7775	16.8974	12.7924	9.5625	8.0730	8.7232	11.3387	15.2188	19.3238	22.5537	24.0432	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	300.2774	303.3934	295.5413	278.8252	257.7241	237.8920	224.6430	221.5270	229.3791	246.0952	267.1963	287.0284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	(71)
Water heating gains (Table 5)	129.4896	126.8354	121.5845	109.8881	102.7644	95.3000	90.6332	94.3644	98.7543	107.0364	118.2386	127.9800	(72)
Total internal gains	549.8877	547.7339	530.7508	498.2333	466.7786	437.9927	420.7271	423.9579	440.0799	469.1831	504.7163	535.7792	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(75)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	48.1118	97.9329	176.4440	289.7718	389.5101	415.2590	388.4663	309.6898	214.9998	119.6818	60.5371	39.2905	(83)
Total gains	597.9995	645.6669	707.1948	788.0051	856.2887	853.2517	809.1933	733.6477	655.0797	588.8649	565.2534	575.0697	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	111.1398	111.6577	112.1805	114.8696	115.4229	118.2717	118.2717	118.8584	117.1155	115.4229	114.3215	113.2409	
alpha	8.4093	8.4438	8.4787	8.6580	8.6949	8.8848	8.8848	8.9239	8.8077	8.6949	8.6214	8.5494	
util living area	0.8907	0.8306	0.7092	0.5274	0.3719	0.2507	0.1817	0.2085	0.3555	0.6018	0.8105	0.9039	(86)
MIT	20.8722	20.9298	20.9803	20.9984	20.9999	21.0000	21.0000	21.0000	21.0000	20.9963	20.9530	20.8608	(87)
Th 2	20.5243	20.5264	20.5285	20.5391	20.5412	20.5518	20.5518	20.5539	20.5476	20.5412	20.5370	20.5327	(88)
util rest of house	0.8771	0.8135	0.6886	0.5076	0.3536	0.2332	0.1632	0.1883	0.3322	0.5761	0.7902	0.8914	(89)
MIT 2	20.3839	20.4516	20.5087	20.5376	20.5412	20.5518	20.5518	20.5539	20.5476	20.5379	20.4887	20.3786	(90)
Living area fraction										fLA = Living area / (4) =		0.4021	(91)
MIT	20.5802	20.6438	20.6983	20.7228	20.7256	20.7320	20.7320	20.7333	20.7295	20.7222	20.6754	20.5725	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5802	20.6438	20.6983	20.7228	20.7256	20.7320	20.7320	20.7333	20.7295	20.7222	20.6754	20.5725	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8788	0.8178	0.6961	0.5155	0.3610	0.2402	0.1707	0.1964	0.3416	0.5863	0.7964	0.8925	(94)
Useful gains	525.5185	528.0545	492.2508	406.2317	309.0939	204.9590	138.1105	144.1228	223.7621	345.2470	450.1599	513.2582	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	579.0763	557.4003	500.3404	406.8764	309.1219	204.9594	138.1105	144.1229	223.7735	346.6793	469.4288	571.5536	(97)
Space heating kWh	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(98a)
Space heating requirement - total per year (kWh/year)												124.3821	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												124.3821	
Space heating per m2										(98c) / (4) =		1.7352	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.2264	11.9464	13.2264	12.7997	13.2264	12.7997	13.2264	13.2264	12.7997	13.2264	12.7997	13.2264	(231)
Lighting	20.4758	16.4264	14.7902	10.8359	8.3700	6.8383	7.6354	9.9247	12.8912	16.9140	19.1043	21.0448	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-17.0008	-26.9528	-43.7049	-55.0326	-64.6365	-62.1981	-61.2076	-55.2744	-45.1885	-33.0016	-19.5873	-14.3353	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.4971	-8.1867	-18.2196	-30.3147	-42.3617	-43.5158	-42.8995	-34.7392	-23.7344	-12.5240	-4.9201	-2.6818	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	124.3821	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2554.7746	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	155.7302	(230a)
Total electricity for the above, kWh/year	155.7302	(231)
Electricity for lighting (calculated in Appendix L)	165.2510	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-765.7149	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2234.4231	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	124.3821	16.4900	20.5106	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	16.4900	421.2823	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	155.7302	16.4900	25.6799	(249)
Energy for lighting	165.2510	16.4900	27.2499	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.1204	16.4900	-82.1401	
PV Unit electricity exported	-267.5945	5.5900	-14.9585	
Total			-97.0986	(252)
Total energy cost			397.6242	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2268	(257)
SAP value	80.1133	
SAP rating (Section 12)	80	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	124.3821	0.1604	19.9497	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2554.7746	0.1413	360.9927	(264)
Space and water heating			380.9424	(265)
Pumps, fans and electric keep-hot	155.7302	0.1387	21.6017	(267)
Energy for lighting	165.2510	0.1443	23.8508	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.1204	0.1323	-65.9162	
PV Unit electricity exported	-267.5945	0.1234	-33.0212	
Total			-98.9374	(269)
Total CO2, kg/year			327.4575	(272)
CO2 emissions per m2			4.5700	(273)
EI value			96.2393	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	71.6800	(1b)	x 2.4000	(2b) =	172.0320	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.6800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		172.0320	(5)

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2. Ventilation rate

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m3 per hour

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	28.6200	11.8100	16.8100	0.1400	2.3534	14.0000	235.3400	(29a)
Total net area of external elements Aum(A, m2)			28.6200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.9475			(33)
Party Wall 1			41.7100	0.0000	0.0000	20.0000	834.2000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			71.6800			80.0000	5734.4000	(32d)
Party Ceiling 1			71.6800			80.0000	5734.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14231.4100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		198.5409 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	10.6000	0.0700	0.7420
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.9000	0.0000	0.0000
E16 Corner (normal)	2.7000	0.0900	0.2430

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		2.2595 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	19.2070 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.5273	16.5273	16.1974	15.2074	15.0424	14.3825	14.0525	14.0525	14.7124	15.5374	15.8674	15.7024	(38)
Heat transfer coeff	35.7343	35.7343	35.4044	34.4144	34.2494	33.5895	33.2595	33.2595	33.9195	34.7444	35.0744	34.9094	(39)
Average = Sum(39)m / 12 =												34.5244	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4985	0.4985	0.4939	0.4801	0.4778	0.4686	0.4640	0.4640	0.4732	0.4847	0.4893	0.4870	(40)
HLP (average)												0.4816	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.2862 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
86.0089	84.7163	82.8328	79.2291	76.5696	73.6038	71.9181	73.7873	75.8363	79.0207	82.7018	85.6793	(42a)

Hot water usage for baths

27.0226	26.6213	26.0561	25.0141	24.2338	23.3686	22.9013	23.4625	24.0735	24.9993	26.0628	26.9312	(42b)

Hot water usage for other uses

38.0431	36.6597	35.2763	33.8929	32.5095	31.1262	31.1262	32.5095	33.8929	35.2763	36.6597	38.0431	(42c)

Average daily hot water use (litres/day)	138.9361 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.0745	147.9973	144.1652	138.1361	133.3130	128.0986	125.9455	129.7594	133.8028	139.2963	145.4243	150.6536	(44)
Energy conte	239.2651	210.7461	221.5766	189.1014	179.4649	157.5122	152.3202	160.6692	164.9922	189.0238	207.1836	235.8872	(45)
Energy content (annual)											Total = Sum(45)m =	2307.7426	

Distribution loss (46)m = 0.15 x (45)m

35.8898	31.6119	33.2365	28.3652	26.9197	23.6268	22.8480	24.1004	24.7488	28.3536	31.0775	35.3831	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680 (64)
										Total per year (kWh/year) = Sum(64)m =		2554.7746 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000 (64a)
Heat gains from water heating, kWh/month												
	96.3403	85.2334	90.4589	79.1194	76.4567	68.6160	67.4311	70.2071	71.1031	79.6351	85.1318	95.2171 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.3930	20.7775	16.8974	12.7924	9.5625	8.0730	8.7232	11.3387	15.2188	19.3238	22.5537	24.0432	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	300.2774	303.3934	295.5413	278.8252	257.7241	237.8920	224.6430	221.5270	229.3791	246.0952	267.1963	287.0284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	(71)
Water heating gains (Table 5)													
	129.4896	126.8354	121.5845	109.8881	102.7644	95.3000	90.6332	94.3644	98.7543	107.0364	118.2386	127.9800	(72)
Total internal gains													
	549.8877	547.7339	530.7508	498.2333	466.7786	437.9927	420.7271	423.9579	440.0799	469.1831	504.7163	535.7792	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(75)

Solar gains	42.7730	92.6022	174.0550	301.5827	403.2921	419.0362	396.3745	305.8819	210.3213	112.3593	55.2465	35.7661	(83)
Total gains	592.6608	640.3361	704.8058	799.8160	870.0707	857.0289	817.1015	729.8397	650.4012	581.5423	559.9628	571.5453	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	110.6266	110.6266	111.6577	114.8696	115.4229	117.6907	118.8584	118.8584	116.5458	113.7786	112.7082	113.2409	
alpha	8.3751	8.3751	8.4438	8.6580	8.6949	8.8460	8.9239	8.9239	8.7697	8.5852	8.5139	8.5494	
util living area													
	0.9065	0.8593	0.7516	0.5619	0.4054	0.3057	0.2483	0.2825	0.4275	0.6674	0.8432	0.9182	(86)
MIT	20.8464	20.9031	20.9677	20.9971	20.9998	21.0000	21.0000	21.0000	20.9998	20.9906	20.9314	20.8348	(87)
Th 2	20.5222	20.5222	20.5264	20.5391	20.5412	20.5497	20.5539	20.5539	20.5455	20.5349	20.5306	20.5327	(88)
util rest of house													
	0.8943	0.8439	0.7321	0.5426	0.3873	0.2881	0.2301	0.2622	0.4039	0.6418	0.8246	0.9073	(89)
MIT 2	20.3514	20.4171	20.4931	20.5364	20.5411	20.5497	20.5539	20.5539	20.5453	20.5262	20.4588	20.3477	(90)
Living area fraction										fLA = Living area / (4) =		0.4021	(91)
MIT	20.5504	20.6125	20.6839	20.7216	20.7255	20.7307	20.7333	20.7333	20.7280	20.7130	20.6488	20.5436	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5504	20.6125	20.6839	20.7216	20.7255	20.7307	20.7333	20.7333	20.7280	20.7130	20.6488	20.5436	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8951	0.8469	0.7387	0.5502	0.3946	0.2951	0.2374	0.2704	0.4134	0.6517	0.8294	0.9075	(94)
Useful gains	530.4783	542.2746	520.6325	440.0970	343.3043	252.9499	194.0117	197.3368	268.8466	378.9737	464.4567	518.6920	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	594.9914	582.9178	534.0374	441.2484	343.3684	252.9535	194.0121	197.3380	268.9149	382.6385	492.7526	587.9989	(97)
Space heating kWh													
	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643	(98a)
Space heating requirement - total per year (kWh/year)												160.8238	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												160.8238	
Space heating per m2											(98c) / (4) =	2.2436	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement												

	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643 (98)
Space heating efficiency (main heating system 1)												
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)												
	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	13.2264	11.9464	13.2264	12.7997	13.2264	12.7997	13.2264	13.2264	12.7997	13.2264	12.7997	13.2264 (231)
Lighting	20.4758	16.4264	14.7902	10.8359	8.3700	6.8383	7.6354	9.9247	12.8912	16.9140	19.1043	21.0448 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-15.4126	-25.9729	-43.7522	-57.3553	-66.8995	-63.0965	-62.6159	-55.2911	-44.8919	-31.6377	-18.2309	-13.2576 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.9589	-7.6180	-18.1511	-32.6607	-45.1941	-44.7217	-44.8029	-34.7587	-23.4550	-11.6200	-4.3363	-2.3448 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	160.8238 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2554.7746 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	155.7302 (230a)
Total electricity for the above, kWh/year	155.7302 (231)
Electricity for lighting (calculated in Appendix L)	165.2510 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-771.0360 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2265.5437 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	160.8238	25.1600	40.4633	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	25.1600	642.7813	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	155.7302	25.1600	39.1817	(249)
Energy for lighting	165.2510	25.1600	41.5772	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.4140	25.1600	-125.4010	
PV Unit electricity exported	-272.6220	5.8100	-15.8393	
Total			-141.2403	(252)
Total energy cost			622.7632	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	160.8238	0.1598	25.6965	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2554.7746	0.1413	360.9927	(264)
Space and water heating			386.6891	(265)
Pumps, fans and electric keep-hot	155.7302	0.1387	21.6017	(267)
Energy for lighting	165.2510	0.1443	23.8508	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.4140	0.1320	-65.8025	
PV Unit electricity exported	-272.6220	0.1229	-33.5042	
Total			-99.3067	(269)
Total CO2, kg/year			332.8350	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	

Space heating - main system 1	160.8238	1.5914	255.9292	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	1.5225	3889.6458	(278)
Space and water heating			4145.5750	(279)
Pumps, fans and electric keep-hot	155.7302	1.5128	235.5887	(281)
Energy for lighting	165.2510	1.5338	253.4676	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.4140	1.4878	-741.5395	
PV Unit electricity exported	-272.6220	0.4510	-122.9601	
Total			-864.4997	(283)
Total Primary energy kWh/year			3770.1316	(286)

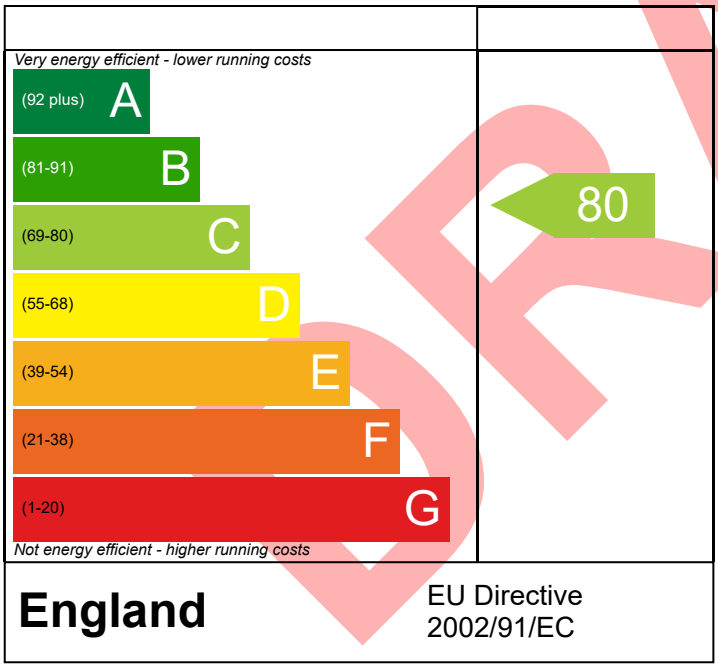
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	71.68 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

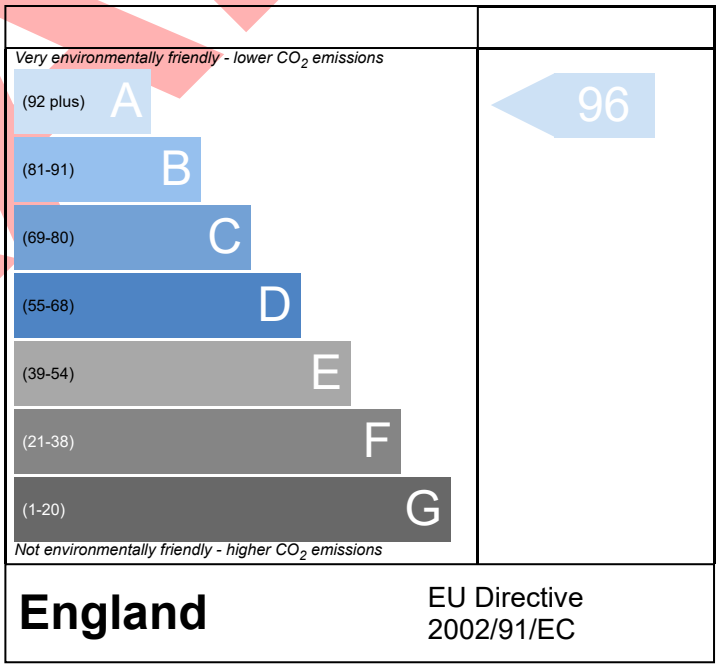
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:41

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	51 m^2
Site Reference	Unit 69 L04_Copy	Plot Reference	Unit 69 L04_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.04 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	5.4 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*60.15 kWh$_{PE}$/m^2*	
Dwelling primary energy	60.84 kWh$_{PE}$/m^2	FAIL
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*11.7 kWh/m^2*	
Dwelling fabric energy efficiency	10.6 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	10.01	0.14 **(!)**
Party wall: Party Wall (1)	46.44	0 **(!)**
Party wall: Party Wall (2)	16.06	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	6.05	South West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.66 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 69 L04_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 69 L04_Copy	**Prop Type Ref**	Unit 69 L04
Property			

SAP Rating	80 C	**DER**	5.40	**TER**	11.04
Environmental	96 A	**% DER < TER**			51.09
CO_2 Emissions (t/year)	0.28	**DFEE**	10.56	**TFEE**	11.66
Compliance Check	See BREL	**% DFEE < TFEE**			9.46
% DPER < TPER	-1.15	**DPER**	60.84	**TPER**	60.15

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.1700	(1b)	x 2.4000	(2b) =	122.8080	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.1700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		122.8080	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												72.0000	(23c)
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.0500	1.2357	7.4762			(27)
External Wall 1	16.0600	6.0500	10.0100	0.1400	1.4014	14.0000	140.1400	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		8.8776			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			16.0600	0.0000	0.0000	20.0000	321.2000	(32)
Party Floor 1			51.1700			80.0000	4093.6000	(32d)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			79.3800			9.0000	714.4200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10291.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		201.1288 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.6000	0.0500	0.1300

E4 Jamb	9.2800	0.0500	0.4640	
E7 Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.3345 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 10.2121 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.6805	11.5628	11.4450	10.8561	10.7383	10.1494	10.1494	10.0316	10.3850	10.7383	10.9739	11.2094	(38)
Heat transfer coeff	21.8927	21.7749	21.6571	21.0682	20.9504	20.3615	20.3615	20.2437	20.5971	20.9504	21.1860	21.4216	(39)
Average = Sum(39)m / 12 =												21.0388	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4278	0.4255	0.4232	0.4117	0.4094	0.3979	0.3979	0.3956	0.4025	0.4094	0.4140	0.4186	(40)
HLP (average)												0.4112	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7246 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.0608	71.9628	70.3629	67.3017	65.0426	62.5233	61.0913	62.6791	64.4197	67.1247	70.2516	72.7809	(42a)
Hot water usage for baths	22.9731	22.6319	22.1514	21.2656	20.6022	19.8667	19.4694	19.9465	20.4660	21.2530	22.1571	22.8954	(42b)
Hot water usage for other uses	32.2915	31.1172	29.9430	28.7688	27.5945	26.4203	26.4203	27.5945	28.7688	29.9430	31.1172	32.2915	(42c)
Average daily hot water use (litres/day)												118.0151	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.3253	125.7119	122.4573	117.3360	113.2393	108.8102	106.9810	110.2201	113.6544	118.3207	123.5260	127.9677	(44)
Energy conte	203.2359	179.0121	188.2123	160.6271	152.4419	133.7949	129.3842	136.4755	140.1472	160.5600	175.9854	200.3665	(45)
Energy content (annual)										Total = Sum(45)m =		1960.2433	
Distribution loss (46)m = 0.15 x (45)m	30.4854	26.8518	28.2318	24.0941	22.8663	20.0692	19.4076	20.4713	21.0221	24.0840	26.3978	30.0550	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
										Total per year (kWh/year) = Sum(64)m =		2207.2753	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	84.3606	74.6819	79.3652	69.6517	67.4716	60.7300	59.8049	62.1628	62.8422	70.1708	74.7583	83.4065	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.5665	16.4906	13.4111	10.1530	7.5895	6.4074	6.9234	8.9993	12.0789	15.3369	17.9004	19.0825	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	224.2868	226.6142	220.7492	208.2634	192.5023	177.6891	167.7930	165.4656	171.3306	183.8164	199.5774	214.3906	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	(71)
Water heating gains (Table 5)	113.3879	111.1337	106.6737	96.7385	90.6876	84.3472	80.3829	83.5521	87.2808	94.3157	103.8310	112.1055	(72)
Total internal gains	437.8050	435.8023	422.3978	396.7187	372.3432	350.0075	336.6631	339.5808	352.2540	375.0327	402.8727	427.1425	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	6.0500	36.7938	0.6300	0.8270	0.7700	80.3729	(79)

Solar gains	80.3729	136.9048	187.3191	232.0975	259.9685	258.0886	248.8249	228.0319	202.8270	151.3090	96.2682	68.7825	(83)
Total gains	518.1779	572.7071	609.7169	628.8162	632.3117	608.0961	585.4880	567.6127	555.0810	526.3417	499.1409	495.9250	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	130.5835	131.2898	132.0039	135.6936	136.4565	140.4031	140.4031	141.2200	138.7974	136.4565	134.9393	133.4554	
alpha	9.7056	9.7527	9.8003	10.0462	10.0971	10.3602	10.3602	10.4147	10.2532	10.0971	9.9960	9.8970	
util living area													
	0.6984	0.6101	0.5147	0.4054	0.3081	0.2143	0.1530	0.1641	0.2560	0.4139	0.5887	0.7171	(86)
MIT	20.9890	20.9967	20.9993	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9999	20.9982	20.9875	(87)
Th 2	20.5874	20.5896	20.5917	20.6024	20.6045	20.6153	20.6153	20.6174	20.6110	20.6045	20.6003	20.5960	(88)
util rest of house													
	0.6823	0.5950	0.5003	0.3921	0.2950	0.2014	0.1396	0.1504	0.2416	0.3982	0.5721	0.7013	(89)
MIT 2	20.5761	20.5862	20.5910	20.6024	20.6045	20.6153	20.6153	20.6174	20.6110	20.6045	20.5985	20.5829	(90)
Living area fraction										fLA = Living area / (4) =		0.5576	(91)
MIT	20.8063	20.8150	20.8187	20.8240	20.8250	20.8298	20.8298	20.8307	20.8279	20.8250	20.8213	20.8085	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.8063	20.8150	20.8187	20.8240	20.8250	20.8298	20.8298	20.8307	20.8279	20.8250	20.8213	20.8085	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6909	0.6033	0.5083	0.3995	0.3023	0.2086	0.1471	0.1580	0.2496	0.4070	0.5813	0.7096	(94)
Useful gains	357.9877	345.5238	309.8992	251.2030	191.1725	126.8478	86.1248	89.6946	138.5746	214.2033	290.1524	351.9190	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	361.3675	346.5482	310.1013	251.2180	191.1733	126.8478	86.1248	89.6946	138.5747	214.2178	290.7000	355.7795	(97)
Space heating kWh													
	2.5146	0.6884	0.1504	0.0108	0.0006	0.0000	0.0000	0.0000	0.0000	0.0108	0.3943	2.8722	(98a)
Space heating requirement - total per year (kWh/year)												6.6421	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	2.5146	0.6884	0.1504	0.0108	0.0006	0.0000	0.0000	0.0000	0.0000	0.0108	0.3943	2.8722	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6.6421	
Space heating per m2											(98c) / (4) =	0.1298	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	2.5146	0.6884	0.1504	0.0108	0.0006	0.0000	0.0000	0.0000	0.0000	0.0108	0.3943	2.8722	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	2.5146	0.6884	0.1504	0.0108	0.0006	0.0000	0.0000	0.0000	0.0000	0.0108	0.3943	2.8722	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9074	8.0454	8.9074	8.6201	8.9074	8.6201	8.9074	8.9074	8.6201	8.9074	8.6201	8.9074	(231)
Lighting	16.2512	13.0373	11.7386	8.6002	6.6431	5.4274	6.0600	7.8770	10.2315	13.4243	15.1627	16.7028	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.1380	-19.3589	-31.6538	-40.1502	-47.3719	-45.6699	-44.9508	-40.4933	-32.9629	-23.9064	-14.0617	-10.2247	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4089	-5.5789	-12.2926	-20.4189	-28.5624	-29.3529	-28.9317	-23.3873	-15.9501	-8.4020	-3.3306	-1.8520	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	6.6421	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2207.2753	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	104.8780	(230a)
Total electricity for the above, kWh/year	104.8780	(231)
Electricity for lighting (calculated in Appendix L)	131.1561	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-543.4106	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1906.5410	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	6.6421	16.4900	1.0953	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	16.4900	363.9797	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	104.8780	16.4900	17.2944	(249)
Energy for lighting	131.1561	16.4900	21.6276	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-362.9424	16.4900	-59.8492	
PV Unit electricity exported	-180.4682	5.5900	-10.0882	
Total			-69.9374	(252)
Total energy cost			334.0596	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2505	(257)
SAP value	79.7292	
SAP rating (Section 12)	80	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6.6421	0.1617	1.0738	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2207.2753	0.1413	311.7942	(264)
Space and water heating			312.8681	(265)
Pumps, fans and electric keep-hot	104.8780	0.1387	14.5479	(267)
Energy for lighting	131.1561	0.1443	18.9299	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-362.9424	0.1322	-47.9814	
PV Unit electricity exported	-180.4682	0.1235	-22.2818	
Total			-70.2632	(269)
Total CO2, kg/year			276.0827	(272)
CO2 emissions per m2			5.4000	(273)
EI value			96.1532	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		51.1700 (1b)	x	2.4000 (2b)	=	122.8080	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.1700						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	122.8080	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.0500	1.2357	7.4762			(27)
External Wall 1	16.0600	6.0500	10.0100	0.1400	1.4014	14.0000	140.1400	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		8.8776			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			16.0600	0.0000	0.0000	20.0000	321.2000	(32)
Party Floor 1			51.1700			80.0000	4093.6000	(32d)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			79.3800			9.0000	714.4200	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 10291.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 201.1288 (35)
List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	2.6000	0.0500	0.1300
E4	Jamb	9.2800	0.0500	0.4640
E7	Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165
E18	Party wall between dwellings	5.4000	0.0600	0.3240
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.3345 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 10.2121 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.7983	11.7983	11.5628	10.8561	10.7383	10.2672	10.0316	10.0316	10.5027	11.0916	11.3272	11.2094	(38)
Heat transfer coeff	22.0105	22.0105	21.7749	21.0682	20.9504	20.4793	20.2437	20.2437	20.7149	21.3038	21.5393	21.4216	(39)

Average = Sum(39)m / 12 = 21.1467

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4301	0.4301	0.4255	0.4117	0.4094	0.4002	0.3956	0.3956	0.4048	0.4163	0.4209	0.4186	(40)
HLP (average)												0.4133	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7246 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.0608	71.9628	70.3629	67.3017	65.0426	62.5233	61.0913	62.6791	64.4197	67.1247	70.2516	72.7809	(42a)
Hot water usage for baths	22.9731	22.6319	22.1514	21.2656	20.6022	19.8667	19.4694	19.9465	20.4660	21.2530	22.1571	22.8954	(42b)
Hot water usage for other uses	32.2915	31.1172	29.9430	28.7688	27.5945	26.4203	26.4203	27.5945	28.7688	29.9430	31.1172	32.2915	(42c)

Average daily hot water use (litres/day) 118.0151 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.3253	125.7119	122.4573	117.3360	113.2393	108.8102	106.9810	110.2201	113.6544	118.3207	123.5260	127.9677	(44)
Energy conte	203.2359	179.0121	188.2123	160.6271	152.4419	133.7949	129.3842	136.4755	140.1472	160.5600	175.9854	200.3665	(45)
Energy content (annual)										Total = Sum(45)m =		1960.2433	
Distribution loss (46)m = 0.15 x (45)m	30.4854	26.8518	28.2318	24.0941	22.8663	20.0692	19.4076	20.4713	21.0221	24.0840	26.3978	30.0550	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
										Total per year (kWh/year) = Sum(64)m =		2207.2753	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	84.3606	74.6819	79.3652	69.6517	67.4716	60.7300	59.8049	62.1628	62.8422	70.1708	74.7583	83.4065	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.5665	16.4906	13.4111	10.1530	7.5895	6.4074	6.9234	8.9993	12.0789	15.3369	17.9004	19.0825	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	224.2868	226.6142	220.7492	208.2634	192.5023	177.6891	167.7930	165.4656	171.3306	183.8164	199.5774	214.3906	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	(71)
Water heating gains (Table 5)													
	113.3879	111.1337	106.6737	96.7385	90.6876	84.3472	80.3829	83.5521	87.2808	94.3157	103.8310	112.1055	(72)
Total internal gains													
	437.8050	435.8023	422.3978	396.7187	372.3432	350.0075	336.6631	339.5808	352.2540	375.0327	402.8727	427.1425	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	6.0500	33.4622	0.6300	0.8270	0.7700	73.0953	(79)

Solar gains	73.0953	132.8884	190.0221	247.6641	274.5958	264.9514	258.6131	230.4683	203.9112	145.9899	89.9762	63.9718	(83)
Total gains	510.9003	568.6907	612.4199	644.3828	646.9390	614.9590	595.2762	570.0491	556.1652	521.0226	492.8488	491.1143	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	129.8847	129.8847	131.2898	135.6936	136.4565	139.5957	141.2200	141.2200	138.0082	134.1933	132.7257	133.4554	
alpha	9.6590	9.6590	9.7527	10.0462	10.0971	10.3064	10.4147	10.4147	10.2005	9.9462	9.8484	9.8970	
util living area													
	0.7262	0.6429	0.5469	0.4283	0.3336	0.2598	0.2074	0.2202	0.3054	0.4619	0.6269	0.7426	(86)
MIT	20.9842	20.9943	20.9987	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9998	20.9964	20.9827	(87)
Th 2	20.5853	20.5853	20.5896	20.6024	20.6045	20.6131	20.6174	20.6174	20.6088	20.5981	20.5938	20.5960	(88)
util rest of house													
	0.7102	0.6276	0.5324	0.4153	0.3207	0.2469	0.1944	0.2066	0.2908	0.4455	0.6097	0.7272	(89)
MIT 2	20.5688	20.5795	20.5883	20.6023	20.6045	20.6131	20.6174	20.6174	20.6088	20.5980	20.5903	20.5778	(90)
Living area fraction										fLA = Living area / (4) =		0.5576	(91)
MIT	20.8004	20.8108	20.8171	20.8240	20.8250	20.8288	20.8307	20.8307	20.8269	20.8220	20.8168	20.8036	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.8004	20.8108	20.8171	20.8240	20.8250	20.8288	20.8307	20.8307	20.8269	20.8220	20.8168	20.8036	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7185	0.6360	0.5404	0.4225	0.3279	0.2541	0.2017	0.2142	0.2990	0.4547	0.6191	0.7352	(94)
Useful gains	367.1006	361.6592	330.9707	272.2579	212.1218	156.2330	120.0602	122.0846	166.2762	236.8899	305.1447	361.0442	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	371.9854	363.4094	331.3518	272.2854	212.1236	156.2331	120.0602	122.0846	166.2767	236.9409	306.2195	366.3847	(97)
Space heating kWh													
	3.6342	1.1761	0.2835	0.0197	0.0014	0.0000	0.0000	0.0000	0.0000	0.0379	0.7738	3.9733	(98a)
Space heating requirement - total per year (kWh/year)												9.9001	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	3.6342	1.1761	0.2835	0.0197	0.0014	0.0000	0.0000	0.0000	0.0000	0.0379	0.7738	3.9733	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9.9001	
Space heating per m2										(98c) / (4) =		0.1935	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	3.6342	1.1761	0.2835	0.0197	0.0014	0.0000	0.0000	0.0000	0.0000	0.0379	0.7738	3.9733	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	3.6342	1.1761	0.2835	0.0197	0.0014	0.0000	0.0000	0.0000	0.0000	0.0379	0.7738	3.9733	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9074	8.0454	8.9074	8.6201	8.9074	8.6201	8.9074	8.9074	8.6201	8.9074	8.6201	8.9074	(231)

Lighting	16.2512	13.0373	11.7386	8.6002	6.6431	5.4274	6.0600	7.8770	10.2315	13.4243	15.1627	16.7028	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.9890	-18.6157	-31.6465	-41.8691	-49.0676	-46.3455	-46.0104	-40.5058	-32.7427	-22.8928	-13.0639	-9.4446	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.0488	-5.2230	-12.2849	-22.0132	-30.4827	-30.1706	-30.2222	-23.4005	-15.7615	-7.8062	-2.9515	-1.6281	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	9.9001	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2207.2753	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	104.8780	(230a)
Total electricity for the above, kWh/year	104.8780	(231)
Electricity for lighting (calculated in Appendix L)	131.1561	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-547.1869	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1906.0227	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	9.9001	25.1600	2.4909	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	25.1600	555.3505	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	104.8780	25.1600	26.3873	(249)
Energy for lighting	131.1561	25.1600	32.9989	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1936	25.1600	-91.3795	
PV Unit electricity exported	-183.9933	5.8100	-10.6900	
Total			-102.0695	(252)
Total energy cost			515.1580	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	9.9001	0.1613	1.5966	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2207.2753	0.1413	311.7942	(264)
Space and water heating			313.3909	(265)
Pumps, fans and electric keep-hot	104.8780	0.1387	14.5479	(267)
Energy for lighting	131.1561	0.1443	18.9299	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1936	0.1319	-47.9013	
PV Unit electricity exported	-183.9933	0.1230	-22.6294	
Total			-70.5307	(269)
Total CO2, kg/year			276.3379	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	9.9001	1.5968	15.8083	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	1.5223	3360.2168	(278)
Space and water heating			3376.0251	(279)
Pumps, fans and electric keep-hot	104.8780	1.5128	158.6595	(281)
Energy for lighting	131.1561	1.5338	201.1716	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1936	1.4873	-540.1750	
PV Unit electricity exported	-183.9933	0.4514	-83.0493	
Total			-623.2243	(283)
Total Primary energy kWh/year			3112.6319	(286)

SAP 10 EPC IMPROVEMENTS

Unit 69 L04_Copy

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 80
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£617	£617	£0
Space heating	£29	£29	£0
Water heating	£555	£555	£0
Lighting	£33	£33	£0
Generated (PV)	-£102	-£102	£0
Total cost of fuels	£515	£515	£0
Total cost of uses	£515	£515	£0
Delivered energy	37 kWh/m²	37 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	61 kWh/m²	61 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.1700 (1b)	x	2.4000 (2b)	=	122.8080	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.1700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	122.8080	(5)

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2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor (20) = 1 - [0.075 x (19)] =		0.7750 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) =		0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.0500	1.2357	7.4762			(27)
External Wall 1	16.0600	6.0500	10.0100	0.1400	1.4014	14.0000	140.1400	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		8.8776			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			16.0600	0.0000	0.0000	20.0000	321.2000	(32)
Party Floor 1			51.1700			80.0000	4093.6000	(32d)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			79.3800			9.0000	714.4200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10291.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		201.1288 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.6000	0.0500	0.1300
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.3345 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	10.2121 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.6805	11.5628	11.4450	10.8561	10.7383	10.1494	10.1494	10.0316	10.3850	10.7383	10.9739	11.2094	(38)
Heat transfer coeff	21.8927	21.7749	21.6571	21.0682	20.9504	20.3615	20.3615	20.2437	20.5971	20.9504	21.1860	21.4216	(39)
Average = Sum(39)m / 12 =												21.0388	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4278	0.4255	0.4232	0.4117	0.4094	0.3979	0.3979	0.3956	0.4025	0.4094	0.4140	0.4186	(40)
HLP (average)												0.4112	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.7246 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.0608	71.9628	70.3629	67.3017	65.0426	62.5233	61.0913	62.6791	64.4197	67.1247	70.2516	72.7809	(42a)

Hot water usage for baths

22.9731	22.6319	22.1514	21.2656	20.6022	19.8667	19.4694	19.9465	20.4660	21.2530	22.1571	22.8954	(42b)

Hot water usage for other uses

32.2915	31.1172	29.9430	28.7688	27.5945	26.4203	26.4203	27.5945	28.7688	29.9430	31.1172	32.2915	(42c)

Average daily hot water use (litres/day)		118.0151 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.3253	125.7119	122.4573	117.3360	113.2393	108.8102	106.9810	110.2201	113.6544	118.3207	123.5260	127.9677	(44)
Energy conte	203.2359	179.0121	188.2123	160.6271	152.4419	133.7949	129.3842	136.4755	140.1472	160.5600	175.9854	200.3665	(45)
Energy content (annual)										Total = Sum(45)m =		1960.2433	

Distribution loss (46)m = 0.15 x (45)m

30.4854	26.8518	28.2318	24.0941	22.8663	20.0692	19.4076	20.4713	21.0221	24.0840	26.3978	30.0550	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
									Total per year (kWh/year) = Sum(64)m =		2207.2753	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

84.3606	74.6819	79.3652	69.6517	67.4716	60.7300	59.8049	62.1628	62.8422	70.1708	74.7583	83.4065	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.5665	16.4906	13.4111	10.1530	7.5895	6.4074	6.9234	8.9993	12.0789	15.3369	17.9004	19.0825	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	224.2868	226.6142	220.7492	208.2634	192.5023	177.6891	167.7930	165.4656	171.3306	183.8164	199.5774	214.3906	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	(71)
Water heating gains (Table 5)	113.3879	111.1337	106.6737	96.7385	90.6876	84.3472	80.3829	83.5521	87.2808	94.3157	103.8310	112.1055	(72)
Total internal gains	437.8050	435.8023	422.3978	396.7187	372.3432	350.0075	336.6631	339.5808	352.2540	375.0327	402.8727	427.1425	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	6.0500	36.7938	0.6300	0.8270	0.7700	80.3729	(79)

Solar gains	80.3729	136.9048	187.3191	232.0975	259.9685	258.0886	248.8249	228.0319	202.8270	151.3090	96.2682	68.7825	(83)
Total gains	518.1779	572.7071	609.7169	628.8162	632.3117	608.0961	585.4880	567.6127	555.0810	526.3417	499.1409	495.9250	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	130.5835	131.2898	132.0039	135.6936	136.4565	140.4031	140.4031	141.2200	138.7974	136.4565	134.9393	133.4554	
alpha	9.7056	9.7527	9.8003	10.0462	10.0971	10.3602	10.3602	10.4147	10.2532	10.0971	9.9960	9.8970	
util living area	0.6984	0.6101	0.5147	0.4054	0.3081	0.2143	0.1530	0.1641	0.2560	0.4139	0.5887	0.7171	(86)
MIT	20.9890	20.9967	20.9993	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9999	20.9982	20.9875	(87)
Th 2	20.5874	20.5896	20.5917	20.6024	20.6045	20.6153	20.6153	20.6174	20.6110	20.6045	20.6003	20.5960	(88)
util rest of house	0.6823	0.5950	0.5003	0.3921	0.2950	0.2014	0.1396	0.1504	0.2416	0.3982	0.5721	0.7013	(89)
MIT 2	20.5761	20.5862	20.5910	20.6024	20.6045	20.6153	20.6153	20.6174	20.6110	20.6045	20.5985	20.5829	(90)
Living area fraction									fLA = Living area / (4) =			0.5576	(91)
MIT	20.8063	20.8150	20.8187	20.8240	20.8250	20.8298	20.8298	20.8307	20.8279	20.8250	20.8213	20.8085	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.8063	20.8150	20.8187	20.8240	20.8250	20.8298	20.8298	20.8307	20.8279	20.8250	20.8213	20.8085	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6909	0.6033	0.5083	0.3995	0.3023	0.2086	0.1471	0.1580	0.2496	0.4070	0.5813	0.7096	(94)
Useful gains	357.9877	345.5238	309.8992	251.2030	191.1725	126.8478	86.1248	89.6946	138.5746	214.2033	290.1524	351.9190	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	361.3675	346.5482	310.1013	251.2180	191.1733	126.8478	86.1248	89.6946	138.5747	214.2178	290.7000	355.7795	(97)
Space heating kWh	2.5146	0.6884	0.1504	0.0108	0.0006	0.0000	0.0000	0.0000	0.0000	0.0108	0.3943	2.8722	(98a)
Space heating requirement - total per year (kWh/year)												6.6421	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	2.5146	0.6884	0.1504	0.0108	0.0006	0.0000	0.0000	0.0000	0.0000	0.0108	0.3943	2.8722	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6.6421	
Space heating per m2											(98c) / (4) =	0.1298	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	2.5146	0.6884	0.1504	0.0108	0.0006	0.0000	0.0000	0.0000	0.0000	0.0108	0.3943	2.8722	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	2.5146	0.6884	0.1504	0.0108	0.0006	0.0000	0.0000	0.0000	0.0000	0.0108	0.3943	2.8722	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9074	8.0454	8.9074	8.6201	8.9074	8.6201	8.9074	8.9074	8.6201	8.9074	8.6201	8.9074	(231)
Lighting	16.2512	13.0373	11.7386	8.6002	6.6431	5.4274	6.0600	7.8770	10.2315	13.4243	15.1627	16.7028	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.1380	-19.3589	-31.6538	-40.1502	-47.3719	-45.6699	-44.9508	-40.4933	-32.9629	-23.9064	-14.0617	-10.2247	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4089	-5.5789	-12.2926	-20.4189	-28.5624	-29.3529	-28.9317	-23.3873	-15.9501	-8.4020	-3.3306	-1.8520	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												6.6421	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2207.2753	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	104.8780	(230a)
Total electricity for the above, kWh/year	104.8780	(231)
Electricity for lighting (calculated in Appendix L)	131.1561	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-543.4106	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1906.5410	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	6.6421	16.4900	1.0953	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	16.4900	363.9797	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	104.8780	16.4900	17.2944	(249)
Energy for lighting	131.1561	16.4900	21.6276	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-362.9424	16.4900	-59.8492	
PV Unit electricity exported	-180.4682	5.5900	-10.0882	
Total			-69.9374	(252)
Total energy cost			334.0596	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2505	(257)
SAP value		79.7292	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6.6421	0.1617	1.0738	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2207.2753	0.1413	311.7942	(264)
Space and water heating			312.8681	(265)
Pumps, fans and electric keep-hot	104.8780	0.1387	14.5479	(267)
Energy for lighting	131.1561	0.1443	18.9299	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-362.9424	0.1322	-47.9814	
PV Unit electricity exported	-180.4682	0.1235	-22.2818	
Total			-70.2632	(269)
Total CO2, kg/year			276.0827	(272)
CO2 emissions per m2			5.4000	(273)
EI value			96.1532	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		51.1700	(1b)	x 2.4000	(2b) =	122.8080	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.1700						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		122.8080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.0500	1.2357	7.4762			(27)
External Wall 1	16.0600	6.0500	10.0100	0.1400	1.4014	14.0000	140.1400	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	8.8776			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			16.0600	0.0000	0.0000	20.0000	321.2000	(32)
Party Floor 1			51.1700			80.0000	4093.6000	(32d)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			79.3800			9.0000	714.4200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10291.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		201.1288 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.6000	0.0500	0.1300
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.3345 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	10.2121 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.7983	11.7983	11.5628	10.8561	10.7383	10.2672	10.0316	10.0316	10.5027	11.0916	11.3272	11.2094	(38)
Heat transfer coeff	22.0105	22.0105	21.7749	21.0682	20.9504	20.4793	20.2437	20.2437	20.7149	21.3038	21.5393	21.4216	(39)
Average = Sum(39)m / 12 =												21.1467	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4301	0.4301	0.4255	0.4117	0.4094	0.4002	0.3956	0.3956	0.4048	0.4163	0.4209	0.4186	(40)
HLP (average)												0.4133	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.7246 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.0608	71.9628	70.3629	67.3017	65.0426	62.5233	61.0913	62.6791	64.4197	67.1247	70.2516	72.7809	(42a)

Hot water usage for baths

22.9731	22.6319	22.1514	21.2656	20.6022	19.8667	19.4694	19.9465	20.4660	21.2530	22.1571	22.8954	(42b)

Hot water usage for other uses

32.2915	31.1172	29.9430	28.7688	27.5945	26.4203	26.4203	27.5945	28.7688	29.9430	31.1172	32.2915	(42c)

Average daily hot water use (litres/day)		118.0151 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.3253	125.7119	122.4573	117.3360	113.2393	108.8102	106.9810	110.2201	113.6544	118.3207	123.5260	127.9677	(44)
Energy conte	203.2359	179.0121	188.2123	160.6271	152.4419	133.7949	129.3842	136.4755	140.1472	160.5600	175.9854	200.3665	(45)
Energy content (annual)										Total = Sum(45)m =		1960.2433	

Distribution loss (46)m = 0.15 x (45)m

30.4854	26.8518	28.2318	24.0941	22.8663	20.0692	19.4076	20.4713	21.0221	24.0840	26.3978	30.0550	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
									Total per year (kWh/year) = Sum(64)m =			2207.2753	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	84.3606	74.6819	79.3652	69.6517	67.4716	60.7300	59.8049	62.1628	62.8422	70.1708	74.7583	83.4065	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.5665	16.4906	13.4111	10.1530	7.5895	6.4074	6.9234	8.9993	12.0789	15.3369	17.9004	19.0825	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	224.2868	226.6142	220.7492	208.2634	192.5023	177.6891	167.7930	165.4656	171.3306	183.8164	199.5774	214.3906	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	(71)
Water heating gains (Table 5)	113.3879	111.1337	106.6737	96.7385	90.6876	84.3472	80.3829	83.5521	87.2808	94.3157	103.8310	112.1055	(72)
Total internal gains	437.8050	435.8023	422.3978	396.7187	372.3432	350.0075	336.6631	339.5808	352.2540	375.0327	402.8727	427.1425	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	6.0500	33.4622	0.6300	0.8270	0.7700	73.0953	(79)

Solar gains	73.0953	132.8884	190.0221	247.6641	274.5958	264.9514	258.6131	230.4683	203.9112	145.9899	89.9762	63.9718	(83)
Total gains	510.9003	568.6907	612.4199	644.3828	646.9390	614.9590	595.2762	570.0491	556.1652	521.0226	492.8488	491.1143	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	129.8847	129.8847	131.2898	135.6936	136.4565	139.5957	141.2200	141.2200	138.0082	134.1933	132.7257	133.4554	
alpha	9.6590	9.6590	9.7527	10.0462	10.0971	10.3064	10.4147	10.4147	10.2005	9.9462	9.8484	9.8970	
util living area	0.7262	0.6429	0.5469	0.4283	0.3336	0.2598	0.2074	0.2202	0.3054	0.4619	0.6269	0.7426	(86)
MIT	20.9842	20.9943	20.9987	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9998	20.9964	20.9827	(87)
Th 2	20.5853	20.5853	20.5896	20.6024	20.6045	20.6131	20.6174	20.6174	20.6088	20.5981	20.5938	20.5960	(88)
util rest of house	0.7102	0.6276	0.5324	0.4153	0.3207	0.2469	0.1944	0.2066	0.2908	0.4455	0.6097	0.7272	(89)
MIT 2	20.5688	20.5795	20.5883	20.6023	20.6045	20.6131	20.6174	20.6174	20.6088	20.5980	20.5903	20.5778	(90)
Living area fraction										fLA = Living area / (4) =		0.5576	(91)
MIT	20.8004	20.8108	20.8171	20.8240	20.8250	20.8288	20.8307	20.8307	20.8269	20.8220	20.8168	20.8036	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.8004	20.8108	20.8171	20.8240	20.8250	20.8288	20.8307	20.8307	20.8269	20.8220	20.8168	20.8036	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7185	0.6360	0.5404	0.4225	0.3279	0.2541	0.2017	0.2142	0.2990	0.4547	0.6191	0.7352	(94)
Useful gains	367.1006	361.6592	330.9707	272.2579	212.1218	156.2330	120.0602	122.0846	166.2762	236.8899	305.1447	361.0442	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	371.9854	363.4094	331.3518	272.2854	212.1236	156.2331	120.0602	122.0846	166.2767	236.9409	306.2195	366.3847	(97)
Space heating kWh	3.6342	1.1761	0.2835	0.0197	0.0014	0.0000	0.0000	0.0000	0.0000	0.0379	0.7738	3.9733	(98a)
Space heating requirement - total per year (kWh/year)												9.9001	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	3.6342	1.1761	0.2835	0.0197	0.0014	0.0000	0.0000	0.0000	0.0000	0.0379	0.7738	3.9733	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9.9001	
Space heating per m2											(98c) / (4) =	0.1935	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	3.6342	1.1761	0.2835	0.0197	0.0014	0.0000	0.0000	0.0000	0.0000	0.0379	0.7738	3.9733	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													

	3.6342	1.1761	0.2835	0.0197	0.0014	0.0000	0.0000	0.0000	0.0000	0.0379	0.7738	3.9733 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	8.9074	8.0454	8.9074	8.6201	8.9074	8.6201	8.9074	8.9074	8.6201	8.9074	8.6201	8.9074 (231)
Lighting	16.2512	13.0373	11.7386	8.6002	6.6431	5.4274	6.0600	7.8770	10.2315	13.4243	15.1627	16.7028 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-10.9890	-18.6157	-31.6465	-41.8691	-49.0676	-46.3455	-46.0104	-40.5058	-32.7427	-22.8928	-13.0639	-9.4446 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.0488	-5.2230	-12.2849	-22.0132	-30.4827	-30.1706	-30.2222	-23.4005	-15.7615	-7.8062	-2.9515	-1.6281 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	9.9001 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2207.2753 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	104.8780 (230a)
Total electricity for the above, kWh/year	104.8780 (231)
Electricity for lighting (calculated in Appendix L)	131.1561 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-547.1869 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1906.0227 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	9.9001	25.1600	2.4909	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	25.1600	555.3505	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	104.8780	25.1600	26.3873	(249)
Energy for lighting	131.1561	25.1600	32.9989	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1936	25.1600	-91.3795	
PV Unit electricity exported	-183.9933	5.8100	-10.6900	
Total			-102.0695	(252)
Total energy cost			515.1580	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	9.9001	0.1613	1.5966	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2207.2753	0.1413	311.7942	(264)
Space and water heating			313.3909	(265)
Pumps, fans and electric keep-hot	104.8780	0.1387	14.5479	(267)
Energy for lighting	131.1561	0.1443	18.9299	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1936	0.1319	-47.9013	
PV Unit electricity exported	-183.9933	0.1230	-22.6294	
Total			-70.5307	(269)
Total CO2, kg/year			276.3379	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	9.9001	1.5968	15.8083	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	1.5223	3360.2168	(278)
Space and water heating			3376.0251	(279)

Pumps, fans and electric keep-hot	104.8780	1.5128	158.6595	(281)
Energy for lighting	131.1561	1.5338	201.1716	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1936	1.4873	-540.1750	
PV Unit electricity exported	-183.9933	0.4514	-83.0493	
Total			-623.2243	(283)
Total Primary energy kWh/year			3112.6319	(286)

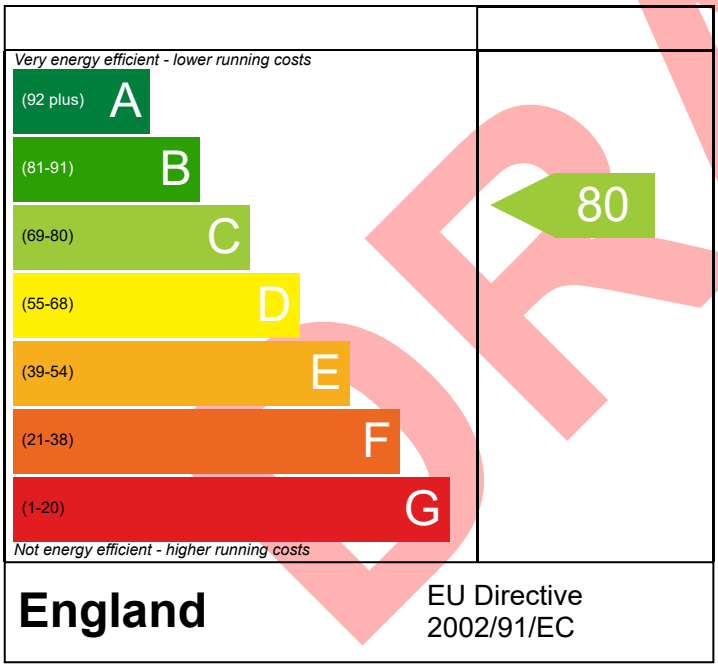
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	51.17 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

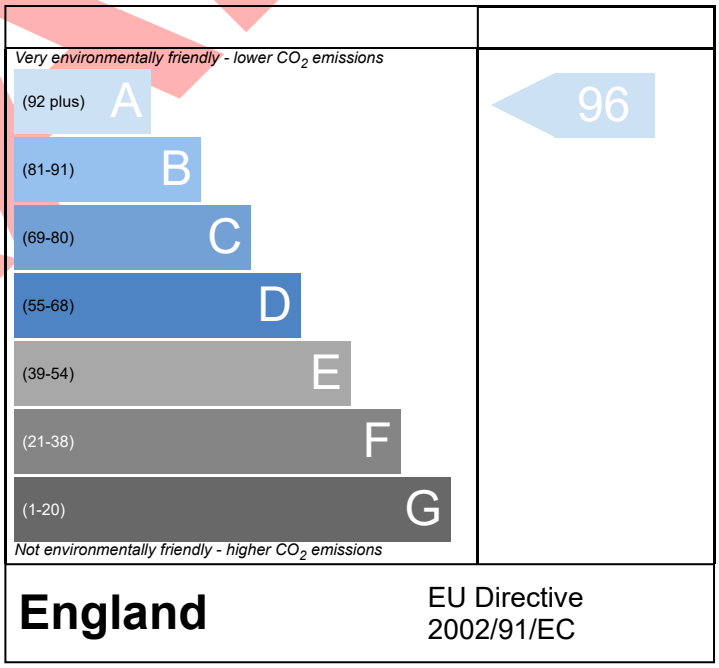
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:42

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	64 m^2
Site Reference	Unit 71 L04_Copy	Plot Reference	Unit 71 L04_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.61 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	5.6 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*62.72 kWh$_{PE}$/m^2*	
Dwelling primary energy	62.24 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*22.8 kWh/m^2*	
Dwelling fabric energy efficiency	23.4 kWh/m^2	FAIL

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	24.52	0.14 **(!)**
Party wall: Party Wall (1)	14.85	0 **(!)**
Party wall: Party Wall (2)	29.36	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	7.88	South West	0.83	1.3
NW, Opening Type 1	11.81	North West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.83 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 71 L04_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 71 L04_Copy	**Prop Type Ref**	Unit 71 L04
Property			

SAP Rating	78 C	**DER**	5.60	**TER**	11.61
Environmental	96 A	**% DER < TER**			51.77
CO_2 Emissions (t/year)	0.36	**DFEE**	23.37	**TFEE**	22.77
Compliance Check	See BREL	**% DFEE < TFEE**			-2.62
% DPER < TPER	0.76	**DPER**	62.24	**TPER**	62.72

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.3100 (1b)	x	2.4000 (2b)	=	154.3440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.3100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	154.3440	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.2100	19.6900	24.5200	0.1400	3.4328	14.0000	343.2800	(29a)
Total net area of external elements Aum(A, m2)			44.2100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.7645			(33)
Party Wall 1			14.8500	0.0000	0.0000	20.0000	297.0000	(32)
Wall to corridor			29.3600	0.0000	0.0000	20.0000	587.2000	(32)
Party Floor 1			64.3100			80.0000	5144.8000	(32d)
Party Ceiling 1			64.3100			80.0000	5144.8000	(32b)
Internal Wall 1			98.7600			9.0000	888.8400	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12405.9200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		192.9081 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240

E4 Jamb	23.2000	0.0500	1.1600	
E7 Party floor between dwellings (in blocks of flats)	16.3700	0.0700	1.1459	
E18 Party wall between dwellings	2.7000	0.0600	0.1620	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	14.9200	0.0000	0.0000	
E16 Corner (normal)	2.7000	0.0900	0.2430	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.1349 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 30.8994 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.4106	15.2482	15.0859	14.2741	14.1118	13.3000	13.3000	13.1377	13.6247	14.1118	14.4365	14.7612	(38)
Heat transfer coeff	46.3100	46.1477	45.9853	45.1736	45.0112	44.1995	44.1995	44.0371	44.5242	45.0112	45.3359	45.6606	(39)
Average = Sum(39)m / 12 =												45.1330	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7201	0.7176	0.7151	0.7024	0.6999	0.6873	0.6873	0.6848	0.6923	0.6999	0.7050	0.7100	(40)
HLP (average)												0.7018	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1005 (42)
Hot water usage for mixer showers

81.7276	80.4994	78.7097	75.2853	72.7583	69.9401	68.3382	70.1144	72.0615	75.0873	78.5852	81.4145	(42a)

Hot water usage for baths

25.6836	25.3022	24.7650	23.7747	23.0331	22.2107	21.7666	22.3000	22.8807	23.7606	24.7714	25.5968	(42b)

Hot water usage for other uses

36.1413	34.8271	33.5129	32.1986	30.8844	29.5702	29.5702	30.8844	32.1986	33.5129	34.8271	36.1413	(42c)

Average daily hot water use (litres/day) 132.0187 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.5526	140.6287	136.9876	131.2586	126.6757	121.7210	119.6750	123.2988	127.1408	132.3608	138.1837	143.1526	(44)
Energy conte	227.3522	200.2534	210.5448	179.6865	170.5299	149.6702	144.7365	152.6697	156.7773	179.6124	196.8681	224.1424	(45)
Energy content (annual)											Total = Sum(45)m =	2192.8435	
Distribution loss (46)m = 0.15 x (45)m	34.1028	30.0380	31.5817	26.9530	25.5795	22.4505	21.7105	22.9004	23.5166	26.9419	29.5302	33.6214	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(64)
									Total per year (kWh/year) = Sum(64)m =		2439.8755	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

92.3793	81.7446	86.7908	75.9890	73.4858	66.0085	64.9095	67.5473	68.3717	76.5058	81.7018	91.3120	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.1424	18.7785	15.2717	11.5617	8.6425	7.2964	7.8840	10.2479	13.7547	17.4647	20.3839	21.7301	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	274.1367	276.9814	269.8129	254.5520	235.2878	217.1823	205.0866	202.2419	209.4104	224.6713	243.9355	262.0411	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(70)
Losses e.g. evaporation (negative values) (Table 5)	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	(71)
Water heating gains (Table 5)	124.1657	121.6437	116.6543	105.5402	98.7713	91.6785	87.2440	90.7894	94.9607	102.8303	113.4748	122.7312	(72)
Total internal gains	511.1586	509.1174	493.4527	463.3677	434.4154	407.8709	391.9284	394.9930	409.8396	436.6802	469.5080	498.2161	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(79)
Northwest	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(81)

Solar gains	152.7958	276.2486	420.4233	592.0739	728.1137	751.4140	712.5556	606.6966	479.1778	316.7586	185.9245	128.8782	(83)
Total gains	663.9545	785.3661	913.8760	1055.4416	1162.5291	1159.2849	1104.4840	1001.6896	889.0173	753.4388	655.4324	627.0944	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	74.4135	74.6752	74.9389	76.2855	76.5607	77.9668	77.9668	78.2542	77.3982	76.5607	76.0123	75.4718	
alpha	5.9609	5.9783	5.9959	6.0857	6.1040	6.1978	6.1978	6.2169	6.1599	6.1040	6.0675	6.0315	
util living area	0.9129	0.8319	0.6961	0.5133	0.3596	0.2440	0.1761	0.2022	0.3452	0.6080	0.8411	0.9285	(86)
MIT	20.6238	20.7983	20.9311	20.9890	20.9988	20.9999	21.0000	21.0000	20.9993	20.9773	20.8219	20.5833	(87)
Th 2	20.3231	20.3253	20.3276	20.3387	20.3409	20.3521	20.3521	20.3543	20.3476	20.3409	20.3365	20.3320	(88)
util rest of house	0.8993	0.8114	0.6697	0.4863	0.3343	0.2193	0.1502	0.1738	0.3127	0.5728	0.8180	0.9169	(89)
MIT 2	19.9049	20.1099	20.2586	20.3287	20.3400	20.3520	20.3521	20.3543	20.3472	20.3210	20.1512	19.8644	(90)
Living area fraction										fLA = Living area / (4) =		0.3816	(91)
MIT	20.1792	20.3726	20.5152	20.5807	20.5914	20.5993	20.5993	20.6007	20.5960	20.5714	20.4071	20.1387	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1792	20.3726	20.5152	20.5807	20.5914	20.5993	20.5993	20.6007	20.5960	20.5714	20.4071	20.1387	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8962	0.8129	0.6772	0.4962	0.3439	0.2287	0.1600	0.1847	0.3251	0.5852	0.8206	0.9132	(94)
Useful gains	595.0388	638.4221	618.8617	523.7474	399.8206	265.1421	176.7657	184.9820	289.0372	440.9435	537.8315	572.6406	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	735.3680	714.0235	644.4936	527.6585	400.2118	265.1640	176.7674	184.9862	289.2306	448.8256	603.2915	727.7727	(97)
Space heating kWh	104.4049	50.8041	19.0701	2.8159	0.2910	0.0000	0.0000	0.0000	0.0000	5.8643	47.1312	115.4183	(98a)
Space heating requirement - total per year (kWh/year)												345.7999	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	104.4049	50.8041	19.0701	2.8159	0.2910	0.0000	0.0000	0.0000	0.0000	5.8643	47.1312	115.4183	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												345.7999	
Space heating per m2											(98c) / (4) =	5.3771	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	104.4049	50.8041	19.0701	2.8159	0.2910	0.0000	0.0000	0.0000	0.0000	5.8643	47.1312	115.4183	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	104.4049	50.8041	19.0701	2.8159	0.2910	0.0000	0.0000	0.0000	0.0000	5.8643	47.1312	115.4183	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.1948	10.1114	11.1948	10.8337	11.1948	10.8337	11.1948	11.1948	10.8337	11.1948	10.8337	11.1948	(231)
Lighting	18.5059	14.8461	13.3673	9.7934	7.5647	6.1804	6.9008	8.9699	11.6510	15.2868	17.2664	19.0202	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.4007	-24.4116	-39.4994	-49.6586	-58.3512	-56.1753	-55.2817	-49.8783	-40.7154	-29.7229	-17.7115	-12.9855	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.8931	-6.9495	-15.7665	-26.5116	-37.1419	-38.1716	-37.6311	-30.4564	-20.7964	-10.9074	-4.1606	-2.2017	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	345.7999	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2439.8755	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	131.8098	(230a)
Total electricity for the above, kWh/year	131.8098	(231)
Electricity for lighting (calculated in Appendix L)	149.3528	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-683.3800	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)

Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2383.4580	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	345.7999	16.4900	57.0224	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2439.8755	16.4900	402.3355	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	131.8098	16.4900	21.7354	(249)
Energy for lighting	149.3528	16.4900	24.6283	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-449.7921	16.4900	-74.1707	
PV Unit electricity exported	-233.5879	5.5900	-13.0576	
Total			-87.2283	(252)
Total energy cost			418.4933	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.3783	(257)
SAP value		77.6584	
SAP rating (Section 12)		78	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	345.7999	0.1597	55.2330	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2439.8755	0.1413	344.7254	(264)
Space and water heating			399.9584	(265)
Pumps, fans and electric keep-hot	131.8098	0.1387	18.2836	(267)
Energy for lighting	149.3528	0.1443	21.5562	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-449.7921	0.1323	-59.5275	
PV Unit electricity exported	-233.5879	0.1231	-28.7646	
Total			-88.2920	(269)
Total CO2, kg/year			351.5063	(272)
CO2 emissions per m2			5.4700	(273)
EI value			95.6910	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		64.3100 (1b)	x	2.4000 (2b)	=	154.3440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.3100						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		154.3440	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.2100	19.6900	24.5200	0.1400	3.4328	14.0000	343.2800	(29a)
Total net area of external elements Aum(A, m2)			44.2100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.7645			(33)
Party Wall 1			14.8500	0.0000	0.0000	20.0000	297.0000	(32)
Wall to corridor			29.3600	0.0000	0.0000	20.0000	587.2000	(32)
Party Floor 1			64.3100			80.0000	5144.8000	(32d)
Party Ceiling 1			64.3100			80.0000	5144.8000	(32b)
Internal Wall 1			98.7600			9.0000	888.8400	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12405.9200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 192.9081 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.3700	0.0700	1.1459
E18 Party wall between dwellings	2.7000	0.0600	0.1620
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	14.9200	0.0000	0.0000
E16 Corner (normal)	2.7000	0.0900	0.2430

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.1349 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 30.8994 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.5729	15.5729	15.2482	14.2741	14.1118	13.4624	13.1377	13.1377	13.7871	14.5988	14.9235	14.7612	(38)
Heat transfer coeff	46.4724	46.4724	46.1477	45.1736	45.0112	44.3618	44.0371	44.0371	44.6865	45.4983	45.8230	45.6606	(39)

Average = Sum(39)m / 12 = 45.2818

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7226	0.7226	0.7176	0.7024	0.6999	0.6898	0.6848	0.6848	0.6949	0.7075	0.7125	0.7100	(40)
HLP (average)												0.7041	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1005 (42)
Hot water usage for mixer showers

81.7276	80.4994	78.7097	75.2853	72.7583	69.9401	68.3382	70.1144	72.0615	75.0873	78.5852	81.4145	(42a)

Hot water usage for baths

25.6836	25.3022	24.7650	23.7747	23.0331	22.2107	21.7666	22.3000	22.8807	23.7606	24.7714	25.5968	(42b)

Hot water usage for other uses

36.1413	34.8271	33.5129	32.1986	30.8844	29.5702	29.5702	30.8844	32.1986	33.5129	34.8271	36.1413	(42c)

Average daily hot water use (litres/day) 132.0187 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.5526	140.6287	136.9876	131.2586	126.6757	121.7210	119.6750	123.2988	127.1408	132.3608	138.1837	143.1526	(44)
Energy conte	227.3522	200.2534	210.5448	179.6865	170.5299	149.6702	144.7365	152.6697	156.7773	179.6124	196.8681	224.1424	(45)
Energy content (annual)											Total = Sum(45)m =	2192.8435	
Distribution loss (46)m = 0.15 x (45)m	34.1028	30.0380	31.5817	26.9530	25.5795	22.4505	21.7105	22.9004	23.5166	26.9419	29.5302	33.6214	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(64)

Total per year (kWh/year) = Sum(64)m = 2439.8755 (64)
Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month

92.3793	81.7446	86.7908	75.9890	73.4858	66.0085	64.9095	67.5473	68.3717	76.5058	81.7018	91.3120	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	21.1424	18.7785	15.2717	11.5617	8.6425	7.2964	7.8840	10.2479	13.7547	17.4647	20.3839	21.7301	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	274.1367	276.9814	269.8129	254.5520	235.2878	217.1823	205.0866	202.2419	209.4104	224.6713	243.9355	262.0411	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	(71)

Water heating gains (Table 5)

	124.1657	121.6437	116.6543	105.5402	98.7713	91.6785	87.2440	90.7894	94.9607	102.8303	113.4748	122.7312	(72)

Total internal gains

	511.1586	509.1174	493.4527	463.3677	434.4154	407.8709	391.9284	394.9930	409.8396	436.6802	469.5080	498.2161	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(79)
Northwest	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(81)

Solar gains	137.9782	265.6866	421.5549	624.1600	760.9473	764.1300	733.2127	606.0620	475.9114	302.5081	172.4386	119.0880	(83)
Total gains	649.1368	774.8041	915.0076	1087.5277	1195.3628	1172.0009	1125.1411	1001.0551	885.7510	739.1883	641.9466	617.3041	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	74.1535	74.1535	74.6752	76.2855	76.5607	77.6814	78.2542	78.2542	77.1170	75.7411	75.2044	75.4718	
alpha	5.9436	5.9436	5.9783	6.0857	6.1040	6.1788	6.2169	6.2169	6.1411	6.0494	6.0136	6.0315	
util living area													
	0.9271	0.8567	0.7305	0.5380	0.3871	0.2951	0.2387	0.2727	0.4126	0.6700	0.8689	0.9400	(86)
MIT	20.5665	20.7475	20.9049	20.9848	20.9980	20.9997	20.9999	20.9999	20.9978	20.9574	20.7701	20.5273	(87)
Th 2	20.3209	20.3209	20.3253	20.3387	20.3409	20.3498	20.3543	20.3543	20.3454	20.3342	20.3298	20.3320	(88)
util rest of house													
	0.9154	0.8384	0.7058	0.5121	0.3626	0.2706	0.2135	0.2443	0.3800	0.6362	0.8486	0.9301	(89)
MIT 2	19.8337	20.0470	20.2278	20.3244	20.3393	20.3496	20.3543	20.3542	20.3438	20.2950	20.0859	19.7960	(90)
Living area fraction										fLA = Living area / (4) =		0.3816	(91)
MIT	20.1133	20.3143	20.4862	20.5764	20.5906	20.5977	20.6007	20.6006	20.5934	20.5478	20.3470	20.0750	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1133	20.3143	20.4862	20.5764	20.5906	20.5977	20.6007	20.6006	20.5934	20.5478	20.3470	20.0750	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9114	0.8382	0.7118	0.5215	0.3719	0.2799	0.2231	0.2551	0.3924	0.6472	0.8492	0.9258	(94)
Useful gains	591.6487	649.4336	651.2843	567.1101	444.5162	328.0844	251.0229	255.4024	347.5726	478.4320	545.1349	571.5150	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	753.4718	744.2246	686.9624	572.6379	445.1895	328.1751	251.0403	255.4414	348.2578	493.5547	629.9265	747.6945	(97)
Space heating kWh													
	120.3964	63.6995	26.5445	3.9801	0.5010	0.0000	0.0000	0.0000	0.0000	11.2513	61.0500	131.0776	(98a)
Space heating requirement - total per year (kWh/year)												418.5003	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	120.3964	63.6995	26.5445	3.9801	0.5010	0.0000	0.0000	0.0000	0.0000	11.2513	61.0500	131.0776	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												418.5003	
Space heating per m2											(98c) / (4) =	6.5075	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	120.3964	63.6995	26.5445	3.9801	0.5010	0.0000	0.0000	0.0000	0.0000	11.2513	61.0500	131.0776	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	120.3964	63.6995	26.5445	3.9801	0.5010	0.0000	0.0000	0.0000	0.0000	11.2513	61.0500	131.0776	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													

	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.1948	10.1114	11.1948	10.8337	11.1948	10.8337	11.1948	11.1948	10.8337	11.1948	10.8337	11.1948	(231)
Lighting	18.5059	14.8461	13.3673	9.7934	7.5647	6.1804	6.9008	8.9699	11.6510	15.2868	17.2664	19.0202	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-13.9632	-23.5442	-39.5900	-51.7924	-60.4179	-56.9935	-56.5645	-49.8935	-40.4465	-28.5276	-16.4999	-12.0106	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4329	-6.4348	-15.6570	-28.5444	-39.6226	-39.2313	-39.3039	-30.4736	-20.5513	-10.0788	-3.6407	-1.9141	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	418.5003	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2439.8755	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	131.8098	(230a)
Total electricity for the above, kWh/year	131.8098	(231)
Electricity for lighting (calculated in Appendix L)	149.3528	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-688.1289	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2451.4094	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	418.5003	25.1600	105.2947	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2439.8755	25.1600	613.8727	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	131.8098	25.1600	33.1633	(249)
Energy for lighting	149.3528	25.1600	37.5772	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-450.2436	25.1600	-113.2813	
PV Unit electricity exported	-237.8853	5.8100	-13.8211	
Total			-127.1024	(252)
Total energy cost			662.8054	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	418.5003	0.1592	66.6275	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2439.8755	0.1413	344.7254	(264)
Space and water heating			411.3529	(265)
Pumps, fans and electric keep-hot	131.8098	0.1387	18.2836	(267)
Energy for lighting	149.3528	0.1443	21.5562	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-450.2436	0.1320	-59.4512	
PV Unit electricity exported	-237.8853	0.1226	-29.1704	
Total			-88.6216	(269)
Total CO2, kg/year			362.5711	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	418.5003	1.5892	665.0908	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2439.8755	1.5225	3714.5924	(278)
Space and water heating			4379.6831	(279)
Pumps, fans and electric keep-hot	131.8098	1.5128	199.4018	(281)
Energy for lighting	149.3528	1.5338	229.0823	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-450.2436	1.4879	-669.9030	
PV Unit electricity exported	-237.8853	0.4500	-107.0542	
Total			-776.9572	(283)
Total Primary energy kWh/year			4031.2101	(286)

SAP 10 EPC IMPROVEMENTS

Unit 71 L04_Copy

Current energy efficiency rating: C 78
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 78
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£790	£790	£0
Space heating	£138	£138	£0
Water heating	£614	£614	£0
Lighting	£38	£38	£0
Generated (PV)	-£127	-£127	£0
Total cost of fuels	£663	£663	£0
Total cost of uses	£663	£663	£0
Delivered energy	38 kWh/m²	38 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	63 kWh/m²	63 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.3100 (1b)	x	2.4000 (2b)	=	154.3440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.3100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	154.3440	(5)

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2. Ventilation rate

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	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.2100	19.6900	24.5200	0.1400	3.4328	14.0000	343.2800	(29a)
Total net area of external elements Aum(A, m2)			44.2100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.7645			(33)
Party Wall 1			14.8500	0.0000	0.0000	20.0000	297.0000	(32)
Wall to corridor			29.3600	0.0000	0.0000	20.0000	587.2000	(32)
Party Floor 1			64.3100			80.0000	5144.8000	(32d)
Party Ceiling 1			64.3100			80.0000	5144.8000	(32b)
Internal Wall 1			98.7600			9.0000	888.8400	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12405.9200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 192.9081 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.3700	0.0700	1.1459
E18 Party wall between dwellings	2.7000	0.0600	0.1620
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	14.9200	0.0000	0.0000
E16 Corner (normal)	2.7000	0.0900	0.2430

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.1349 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 30.8994 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.4106	15.2482	15.0859	14.2741	14.1118	13.3000	13.3000	13.1377	13.6247	14.1118	14.4365	14.7612	(38)
Heat transfer coeff	46.3100	46.1477	45.9853	45.1736	45.0112	44.1995	44.1995	44.0371	44.5242	45.0112	45.3359	45.6606	(39)
Average = Sum(39)m / 12 =												45.1330	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7201	0.7176	0.7151	0.7024	0.6999	0.6873	0.6873	0.6848	0.6923	0.6999	0.7050	0.7100	(40)
HLP (average)												0.7018	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1005 (42)
Hot water usage for mixer showers

81.7276	80.4994	78.7097	75.2853	72.7583	69.9401	68.3382	70.1144	72.0615	75.0873	78.5852	81.4145	(42a)

Hot water usage for baths

25.6836	25.3022	24.7650	23.7747	23.0331	22.2107	21.7666	22.3000	22.8807	23.7606	24.7714	25.5968	(42b)

Hot water usage for other uses

36.1413	34.8271	33.5129	32.1986	30.8844	29.5702	29.5702	30.8844	32.1986	33.5129	34.8271	36.1413	(42c)

Average daily hot water use (litres/day) 132.0187 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.5526	140.6287	136.9876	131.2586	126.6757	121.7210	119.6750	123.2988	127.1408	132.3608	138.1837	143.1526	(44)
Energy conte	227.3522	200.2534	210.5448	179.6865	170.5299	149.6702	144.7365	152.6697	156.7773	179.6124	196.8681	224.1424	(45)
Energy content (annual)										Total = Sum(45)m =		2192.8435	
Distribution loss (46)m = 0.15 x (45)m	34.1028	30.0380	31.5817	26.9530	25.5795	22.4505	21.7105	22.9004	23.5166	26.9419	29.5302	33.6214	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(64)
										Total per year (kWh/year) = Sum(64)m =		2439.8755	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	92.3793	81.7446	86.7908	75.9890	73.4858	66.0085	64.9095	67.5473	68.3717	76.5058	81.7018	91.3120	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.1424	18.7785	15.2717	11.5617	8.6425	7.2964	7.8840	10.2479	13.7547	17.4647	20.3839	21.7301	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	274.1367	276.9814	269.8129	254.5520	235.2878	217.1823	205.0866	202.2419	209.4104	224.6713	243.9355	262.0411	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	(71)
Water heating gains (Table 5)	124.1657	121.6437	116.6543	105.5402	98.7713	91.6785	87.2440	90.7894	94.9607	102.8303	113.4748	122.7312	(72)
Total internal gains	511.1586	509.1174	493.4527	463.3677	434.4154	407.8709	391.9284	394.9930	409.8396	436.6802	469.5080	498.2161	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(79)
Northwest	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(81)

Solar gains	152.7958	276.2486	420.4233	592.0739	728.1137	751.4140	712.5556	606.6966	479.1778	316.7586	185.9245	128.8782	(83)
Total gains	663.9545	785.3661	913.8760	1055.4416	1162.5291	1159.2849	1104.4840	1001.6896	889.0173	753.4388	655.4324	627.0944	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	74.4135	74.6752	74.9389	76.2855	76.5607	77.9668	77.9668	78.2542	77.3982	76.5607	76.0123	75.4718	
alpha	5.9609	5.9783	5.9959	6.0857	6.1040	6.1978	6.1978	6.2169	6.1599	6.1040	6.0675	6.0315	
util living area	0.9129	0.8319	0.6961	0.5133	0.3596	0.2440	0.1761	0.2022	0.3452	0.6080	0.8411	0.9285	(86)
MIT	20.6238	20.7983	20.9311	20.9890	20.9988	20.9999	21.0000	21.0000	20.9993	20.9773	20.8219	20.5833	(87)
Th 2	20.3231	20.3253	20.3276	20.3387	20.3409	20.3521	20.3521	20.3543	20.3476	20.3409	20.3365	20.3320	(88)
util rest of house	0.8993	0.8114	0.6697	0.4863	0.3343	0.2193	0.1502	0.1738	0.3127	0.5728	0.8180	0.9169	(89)
MIT 2	19.9049	20.1099	20.2586	20.3287	20.3400	20.3520	20.3521	20.3543	20.3472	20.3210	20.1512	19.8644	(90)
Living area fraction									fLA = Living area / (4) =			0.3816	(91)
MIT	20.1792	20.3726	20.5152	20.5807	20.5914	20.5993	20.5993	20.6007	20.5960	20.5714	20.4071	20.1387	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1792	20.3726	20.5152	20.5807	20.5914	20.5993	20.5993	20.6007	20.5960	20.5714	20.4071	20.1387	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8962	0.8129	0.6772	0.4962	0.3439	0.2287	0.1600	0.1847	0.3251	0.5852	0.8206	0.9132	(94)
Useful gains	595.0388	638.4221	618.8617	523.7474	399.8206	265.1421	176.7657	184.9820	289.0372	440.9435	537.8315	572.6406	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	735.3680	714.0235	644.4936	527.6585	400.2118	265.1640	176.7674	184.9862	289.2306	448.8256	603.2915	727.7727	(97)
Space heating kWh	104.4049	50.8041	19.0701	2.8159	0.2910	0.0000	0.0000	0.0000	0.0000	5.8643	47.1312	115.4183	(98a)
Space heating requirement - total per year (kWh/year)												345.7999	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	104.4049	50.8041	19.0701	2.8159	0.2910	0.0000	0.0000	0.0000	0.0000	5.8643	47.1312	115.4183	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												345.7999	
Space heating per m2											(98c) / (4) =	5.3771	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	104.4049	50.8041	19.0701	2.8159	0.2910	0.0000	0.0000	0.0000	0.0000	5.8643	47.1312	115.4183	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	104.4049	50.8041	19.0701	2.8159	0.2910	0.0000	0.0000	0.0000	0.0000	5.8643	47.1312	115.4183	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.1948	10.1114	11.1948	10.8337	11.1948	10.8337	11.1948	11.1948	10.8337	11.1948	10.8337	11.1948	(231)
Lighting	18.5059	14.8461	13.3673	9.7934	7.5647	6.1804	6.9008	8.9699	11.6510	15.2868	17.2664	19.0202	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.4007	-24.4116	-39.4994	-49.6586	-58.3512	-56.1753	-55.2817	-49.8783	-40.7154	-29.7229	-17.7115	-12.9855	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.8931	-6.9495	-15.7665	-26.5116	-37.1419	-38.1716	-37.6311	-30.4564	-20.7964	-10.9074	-4.1606	-2.2017	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity)

(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year		
Space heating fuel - main system 1	345.7999	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2439.8755	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	131.8098	(230a)
Total electricity for the above, kWh/year	131.8098	(231)
Electricity for lighting (calculated in Appendix L)	149.3528	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-683.3800	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2383.4580	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	345.7999	16.4900	57.0224	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2439.8755	16.4900	402.3355	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	131.8098	16.4900	21.7354	(249)
Energy for lighting	149.3528	16.4900	24.6283	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-449.7921	16.4900	-74.1707	
PV Unit electricity exported	-233.5879	5.5900	-13.0576	
Total			-87.2283	(252)
Total energy cost			418.4933	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.3783	(257)
SAP value	77.6584	
SAP rating (Section 12)	78	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	345.7999	0.1597	55.2330	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2439.8755	0.1413	344.7254	(264)
Space and water heating			399.9584	(265)
Pumps, fans and electric keep-hot	131.8098	0.1387	18.2836	(267)
Energy for lighting	149.3528	0.1443	21.5562	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-449.7921	0.1323	-59.5275	
PV Unit electricity exported	-233.5879	0.1231	-28.7646	
Total			-88.2920	(269)
Total CO2, kg/year			351.5063	(272)
CO2 emissions per m2			5.4700	(273)
EI value			95.6910	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		64.3100 (1b)	x	2.4000 (2b)	=	154.3440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.3100						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		154.3440	(5)

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2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.2100	19.6900	24.5200	0.1400	3.4328	14.0000	343.2800	(29a)
Total net area of external elements Aum(A, m2)			44.2100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.7645			(33)
Party Wall 1			14.8500	0.0000	0.0000	20.0000	297.0000	(32)
Wall to corridor			29.3600	0.0000	0.0000	20.0000	587.2000	(32)
Party Floor 1			64.3100			80.0000	5144.8000	(32d)
Party Ceiling 1			64.3100			80.0000	5144.8000	(32b)
Internal Wall 1			98.7600			9.0000	888.8400	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12405.9200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		192.9081 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.3700	0.0700	1.1459
E18 Party wall between dwellings	2.7000	0.0600	0.1620
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	14.9200	0.0000	0.0000
E16 Corner (normal)	2.7000	0.0900	0.2430

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.1349 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	30.8994 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.5729	15.5729	15.2482	14.2741	14.1118	13.4624	13.1377	13.1377	13.7871	14.5988	14.9235	14.7612	(38)
Heat transfer coeff	46.4724	46.4724	46.1477	45.1736	45.0112	44.3618	44.0371	44.0371	44.6865	45.4983	45.8230	45.6606	(39)
Average = Sum(39)m / 12 =												45.2818	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7226	0.7226	0.7176	0.7024	0.6999	0.6898	0.6848	0.6848	0.6949	0.7075	0.7125	0.7100	(40)
HLP (average)												0.7041	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.1005 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
81.7276	80.4994	78.7097	75.2853	72.7583	69.9401	68.3382	70.1144	72.0615	75.0873	78.5852	81.4145	(42a)

Hot water usage for baths

25.6836	25.3022	24.7650	23.7747	23.0331	22.2107	21.7666	22.3000	22.8807	23.7606	24.7714	25.5968	(42b)

Hot water usage for other uses

36.1413	34.8271	33.5129	32.1986	30.8844	29.5702	29.5702	30.8844	32.1986	33.5129	34.8271	36.1413	(42c)

Average daily hot water use (litres/day)	132.0187 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.5526	140.6287	136.9876	131.2586	126.6757	121.7210	119.6750	123.2988	127.1408	132.3608	138.1837	143.1526	(44)
Energy conte	227.3522	200.2534	210.5448	179.6865	170.5299	149.6702	144.7365	152.6697	156.7773	179.6124	196.8681	224.1424	(45)
Energy content (annual)										Total = Sum(45)m =		2192.8435	
Distribution loss (46)m = 0.15 x (45)m	34.1028	30.0380	31.5817	26.9530	25.5795	22.4505	21.7105	22.9004	23.5166	26.9419	29.5302	33.6214	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(64)
									Total per year (kWh/year) = Sum(64)m =			2439.8755	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month													
	92.3793	81.7446	86.7908	75.9890	73.4858	66.0085	64.9095	67.5473	68.3717	76.5058	81.7018	91.3120	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.1424	18.7785	15.2717	11.5617	8.6425	7.2964	7.8840	10.2479	13.7547	17.4647	20.3839	21.7301	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	274.1367	276.9814	269.8129	254.5520	235.2878	217.1823	205.0866	202.2419	209.4104	224.6713	243.9355	262.0411	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	(71)
Water heating gains (Table 5)													
	124.1657	121.6437	116.6543	105.5402	98.7713	91.6785	87.2440	90.7894	94.9607	102.8303	113.4748	122.7312	(72)
Total internal gains													
	511.1586	509.1174	493.4527	463.3677	434.4154	407.8709	391.9284	394.9930	409.8396	436.6802	469.5080	498.2161	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(79)
Northwest	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(81)

Solar gains	137.9782	265.6866	421.5549	624.1600	760.9473	764.1300	733.2127	606.0620	475.9114	302.5081	172.4386	119.0880	(83)
Total gains	649.1368	774.8041	915.0076	1087.5277	1195.3628	1172.0009	1125.1411	1001.0551	885.7510	739.1883	641.9466	617.3041	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	74.1535	74.1535	74.6752	76.2855	76.5607	77.6814	78.2542	78.2542	77.1170	75.7411	75.2044	75.4718	
alpha	5.9436	5.9436	5.9783	6.0857	6.1040	6.1788	6.2169	6.2169	6.1411	6.0494	6.0136	6.0315	
util living area													
	0.9271	0.8567	0.7305	0.5380	0.3871	0.2951	0.2387	0.2727	0.4126	0.6700	0.8689	0.9400	(86)
MIT	20.5665	20.7475	20.9049	20.9848	20.9980	20.9997	20.9999	20.9999	20.9978	20.9574	20.7701	20.5273	(87)
Th 2	20.3209	20.3209	20.3253	20.3387	20.3409	20.3498	20.3543	20.3543	20.3454	20.3342	20.3298	20.3320	(88)
util rest of house													
	0.9154	0.8384	0.7058	0.5121	0.3626	0.2706	0.2135	0.2443	0.3800	0.6362	0.8486	0.9301	(89)
MIT 2	19.8337	20.0470	20.2278	20.3244	20.3393	20.3496	20.3543	20.3542	20.3438	20.2950	20.0859	19.7960	(90)
Living area fraction										fLA = Living area / (4) =		0.3816	(91)
MIT	20.1133	20.3143	20.4862	20.5764	20.5906	20.5977	20.6007	20.6006	20.5934	20.5478	20.3470	20.0750	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1133	20.3143	20.4862	20.5764	20.5906	20.5977	20.6007	20.6006	20.5934	20.5478	20.3470	20.0750	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9114	0.8382	0.7118	0.5215	0.3719	0.2799	0.2231	0.2551	0.3924	0.6472	0.8492	0.9258	(94)
Useful gains	591.6487	649.4336	651.2843	567.1101	444.5162	328.0844	251.0229	255.4024	347.5726	478.4320	545.1349	571.5150	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	753.4718	744.2246	686.9624	572.6379	445.1895	328.1751	251.0403	255.4414	348.2578	493.5547	629.9265	747.6945	(97)
Space heating kWh													
	120.3964	63.6995	26.5445	3.9801	0.5010	0.0000	0.0000	0.0000	0.0000	11.2513	61.0500	131.0776	(98a)
Space heating requirement - total per year (kWh/year)												418.5003	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	120.3964	63.6995	26.5445	3.9801	0.5010	0.0000	0.0000	0.0000	0.0000	11.2513	61.0500	131.0776	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												418.5003	
Space heating per m2											(98c) / (4) =	6.5075	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	120.3964	63.6995	26.5445	3.9801	0.5010	0.0000	0.0000	0.0000	0.0000	11.2513	61.0500	131.0776	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	120.3964	63.6995	26.5445	3.9801	0.5010	0.0000	0.0000	0.0000	0.0000	11.2513	61.0500	131.0776	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.1948	10.1114	11.1948	10.8337	11.1948	10.8337	11.1948	11.1948	10.8337	11.1948	10.8337	11.1948	(231)
Lighting	18.5059	14.8461	13.3673	9.7934	7.5647	6.1804	6.9008	8.9699	11.6510	15.2868	17.2664	19.0202	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-13.9632	-23.5442	-39.5900	-51.7924	-60.4179	-56.9935	-56.5645	-49.8935	-40.4465	-28.5276	-16.4999	-12.0106	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4329	-6.4348	-15.6570	-28.5444	-39.6226	-39.2313	-39.3039	-30.4736	-20.5513	-10.0788	-3.6407	-1.9141	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1	418.5003	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2439.8755	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	131.8098	(230a)
Total electricity for the above, kWh/year	131.8098	(231)
Electricity for lighting (calculated in Appendix L)	149.3528	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-688.1289	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2451.4094	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	418.5003	25.1600	105.2947	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2439.8755	25.1600	613.8727	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	131.8098	25.1600	33.1633	(249)
Energy for lighting	149.3528	25.1600	37.5772	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-450.2436	25.1600	-113.2813	
PV Unit electricity exported	-237.8853	5.8100	-13.8211	
Total			-127.1024	(252)
Total energy cost			662.8054	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	418.5003	0.1592	66.6275	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2439.8755	0.1413	344.7254	(264)
Space and water heating			411.3529	(265)
Pumps, fans and electric keep-hot	131.8098	0.1387	18.2836	(267)
Energy for lighting	149.3528	0.1443	21.5562	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-450.2436	0.1320	-59.4512	
PV Unit electricity exported	-237.8853	0.1226	-29.1704	
Total			-88.6216	(269)
Total CO2, kg/year			362.5711	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	418.5003	1.5892	665.0908	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2439.8755	1.5225	3714.5924	(278)
Space and water heating			4379.6831	(279)
Pumps, fans and electric keep-hot	131.8098	1.5128	199.4018	(281)
Energy for lighting	149.3528	1.5338	229.0823	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-450.2436	1.4879	-669.9030	
PV Unit electricity exported	-237.8853	0.4500	-107.0542	
Total			-776.9572	(283)
Total Primary energy kWh/year			4031.2101	(286)

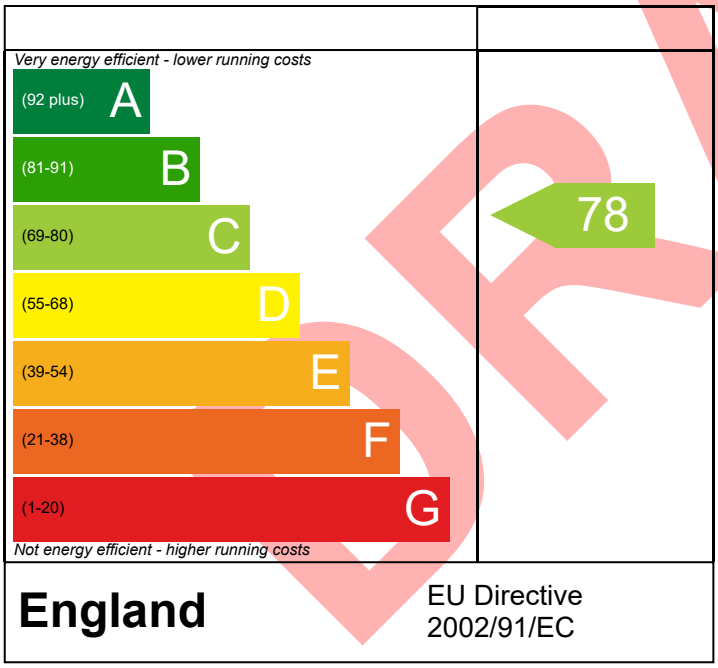
Predicted Energy Assessment

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	64.31 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

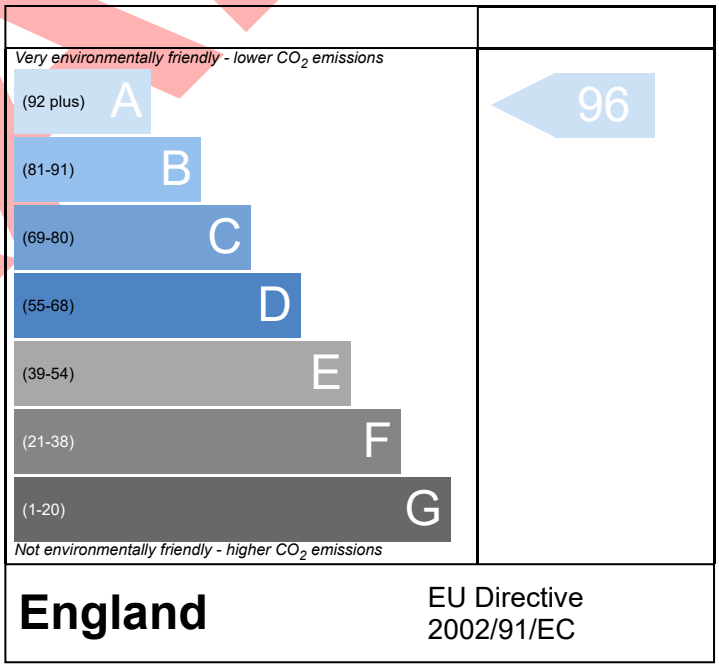
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:43

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	46 m^2
Site Reference	Unit 72 L04_Copy	Plot Reference	Unit 72 L04_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.91 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	5.82 $kgCO_2/m^2$	**OK**
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*64.84 kWh_{PE}/m^2*	
Dwelling primary energy	65.21 kWh_{PE}/m^2	**FAIL**
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*13.1 kWh/m^2*	
Dwelling fabric energy efficiency	12.0 kWh/m^2	**OK**

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	**OK**
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	**OK**
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	8.88	0.14 **(!)**
Party wall: Party Wall (1)	23.22	0 **(!)**
Party wall: Party Wall (2)	39.28	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	7.18	South West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.59 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 72 L04_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 72 L04_Copy	**Prop Type Ref**	Unit 72 L04
Property			

SAP Rating	79 C	**DER**	5.82	**TER**	11.91
Environmental	96 A	**% DER < TER**			51.13
CO_2 Emissions (t/year)	0.27	**DFEE**	12.01	**TFEE**	13.06
Compliance Check	See BREL	**% DFEE < TFEE**			8.05
% DPER < TPER	-0.58	**DPER**	65.21	**TPER**	64.84

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.9900 (1b)	x	2.4000 (2b)	=	110.3760	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.9900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	110.3760	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.1800	1.2357	8.8726			(27)
External Wall 1	16.0600	7.1800	8.8800	0.1400	1.2432	14.0000	124.3200	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.1158			(33)
Party Wall 1			23.2200	0.0000	0.0000	20.0000	464.4000	(32)
Wall to corridor			39.2800	0.0000	0.0000	20.0000	785.6000	(32)
Party Floor 1			45.9900			80.0000	3679.2000	(32d)
Party Ceiling 1			45.9900			80.0000	3679.2000	(32b)
Internal Wall 1			66.6300			9.0000	599.6700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9332.3900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.9222 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695

E4 Jamb	9.2800	0.0500	0.4640	
E7 Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165	
E18 Party wall between dwellings	2.7000	0.0600	0.1620	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.2120 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 11.3278 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	10.4981	10.3922	10.2864	9.7571	9.6512	9.1220	9.1220	9.0161	9.3337	9.6512	9.8630	10.0747	(38)
Heat transfer coeff	21.8259	21.7201	21.6142	21.0849	20.9791	20.4498	20.4498	20.3439	20.6615	20.9791	21.1908	21.4025	(39)

Average = Sum(39)m / 12 = 21.0585

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4746	0.4723	0.4700	0.4585	0.4562	0.4447	0.4447	0.4424	0.4493	0.4562	0.4608	0.4654	(40)
HLP (average)												0.4579	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.5731 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	69.5673	68.5219	66.9984	64.0836	61.9325	59.5337	58.1702	59.6821	61.3394	63.9151	66.8925	69.3008	(42a)
Hot water usage for baths	21.8805	21.5555	21.0979	20.2542	19.6224	18.9219	18.5435	18.9979	19.4926	20.2422	21.1034	21.8065	(42b)
Hot water usage for other uses	30.7397	29.6219	28.5041	27.3863	26.2684	25.1506	25.1506	26.2684	27.3863	28.5041	29.6219	30.7397	(42c)

Average daily hot water use (litres/day) 112.3706 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	122.1875	119.6993	116.6004	111.7240	107.8234	103.6062	101.8643	104.9484	108.2183	112.6614	117.6177	121.8470	(44)
Energy conte	193.5151	170.4502	179.2105	152.9446	145.1510	127.3959	123.1960	129.9480	133.4440	152.8804	167.5680	190.7830	(45)

Energy content (annual) Total = Sum(45)m = 1866.4867

Distribution loss (46)m = 0.15 x (45)m	29.0273	25.5675	26.8816	22.9417	21.7726	19.1094	18.4794	19.4922	20.0166	22.9321	25.1352	28.6174	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(64)

Total per year (kWh/year) = Sum(64)m = 2113.5187 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	81.1284	71.8350	76.3721	67.0973	65.0473	58.6023	57.7473	59.9924	60.6133	67.6174	71.9596	80.2200	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.0271	14.2351	11.5768	8.7644	6.5515	5.5310	5.9765	7.7684	10.4268	13.2392	15.4521	16.4725	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	204.2328	206.3521	201.0115	189.6421	175.2902	161.8015	152.7902	150.6709	156.0115	167.3809	181.7328	195.2215	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	(71)
Water heating gains (Table 5)	109.0436	106.8973	102.6507	93.1907	87.4292	81.3921	77.6173	80.6349	84.1852	90.8836	99.9438	107.8225	(72)
Total internal gains	406.7760	404.9571	392.7115	369.0697	346.7435	326.1972	313.8566	316.5468	328.0960	348.9762	374.6012	396.9891	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.1800	36.7938	0.6300	0.8270	0.7700	95.3847	(79)

Solar gains	95.3847	162.4755	222.3060	275.4479	308.5246	306.2935	295.2996	270.6229	240.7104	179.5700	114.2489	81.6294	(83)
Total gains	502.1607	567.4325	615.0175	644.5176	655.2681	632.4907	609.1562	587.1697	568.8063	528.5462	488.8501	478.6185	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	118.7730	119.3519	119.9364	122.9471	123.5675	126.7657	126.7657	127.4253	125.4668	123.5675	122.3329	121.1228	
alpha	8.9182	8.9568	8.9958	9.1965	9.2378	9.4510	9.4510	9.4950	9.3645	9.2378	9.1555	9.0749	
util living area													
	0.7139	0.6132	0.5090	0.3958	0.2977	0.2069	0.1477	0.1594	0.2506	0.4127	0.6002	0.7365	(86)
MIT	20.9808	20.9943	20.9989	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9999	20.9963	20.9773	(87)
Th 2	20.5442	20.5463	20.5484	20.5590	20.5612	20.5718	20.5718	20.5740	20.5676	20.5612	20.5569	20.5527	(88)
util rest of house													
	0.6964	0.5965	0.4933	0.3814	0.2837	0.1931	0.1333	0.1446	0.2349	0.3953	0.5816	0.7193	(89)
MIT 2	20.5244	20.5406	20.5473	20.5590	20.5612	20.5718	20.5718	20.5740	20.5676	20.5611	20.5534	20.5290	(90)
Living area fraction										fLA = Living area / (4) =		0.5849	(91)
MIT	20.7914	20.8060	20.8114	20.8169	20.8178	20.8223	20.8223	20.8232	20.8205	20.8177	20.8125	20.7912	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7914	20.8060	20.8114	20.8169	20.8178	20.8223	20.8223	20.8232	20.8205	20.8177	20.8125	20.7912	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7060	0.6060	0.5024	0.3898	0.2919	0.2012	0.1417	0.1533	0.2441	0.4055	0.5923	0.7285	(94)
Useful gains	354.5074	343.8804	309.0123	251.2398	191.2823	127.2439	86.3444	89.9842	138.8553	214.3281	289.5660	348.6732	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	359.9391	345.4791	309.3302	251.2663	191.2838	127.2440	86.3444	89.9842	138.8555	214.3586	290.5780	355.0941	(97)
Space heating kWh													
	4.0412	1.0743	0.2365	0.0191	0.0012	0.0000	0.0000	0.0000	0.0000	0.0227	0.7287	4.7771	(98a)
Space heating requirement - total per year (kWh/year)												10.9008	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	4.0412	1.0743	0.2365	0.0191	0.0012	0.0000	0.0000	0.0000	0.0000	0.0227	0.7287	4.7771	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												10.9008	
Space heating per m2											(98c) / (4) =	0.2370	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	4.0412	1.0743	0.2365	0.0191	0.0012	0.0000	0.0000	0.0000	0.0000	0.0227	0.7287	4.7771	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	4.0412	1.0743	0.2365	0.0191	0.0012	0.0000	0.0000	0.0000	0.0000	0.0227	0.7287	4.7771	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.0057	7.2310	8.0057	7.7475	8.0057	7.7475	8.0057	8.0057	7.7475	8.0057	7.7475	8.0057	(231)
Lighting	14.0284	11.2541	10.1331	7.4239	5.7345	4.6851	5.2312	6.7997	8.8321	11.5882	13.0888	14.4183	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.8993	-17.4078	-28.5102	-36.2313	-42.8143	-41.3038	-40.6546	-36.5886	-29.7380	-21.5191	-12.6327	-9.1789	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.1048	-4.8851	-10.7752	-17.9137	-25.0663	-25.7620	-25.3918	-20.5168	-13.9872	-7.3627	-2.9149	-1.6169	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	10.9008	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2113.5187	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	94.2611	(230a)
Total electricity for the above, kWh/year	94.2611	(231)
Electricity for lighting (calculated in Appendix L)	113.2174	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-485.7761	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1846.1219	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	10.9008	16.4900	1.7975	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2113.5187	16.4900	348.5192	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	94.2611	16.4900	15.5437	(249)
Energy for lighting	113.2174	16.4900	18.6696	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-327.4788	16.4900	-54.0013	
PV Unit electricity exported	-158.2973	5.5900	-8.8488	
Total			-62.8501	(252)
Total energy cost			321.6799	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2727	(257)
SAP value		79.3692	
SAP rating (Section 12)		79	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	10.9008	0.1616	1.7615	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2113.5187	0.1412	298.5203	(264)
Space and water heating			300.2818	(265)
Pumps, fans and electric keep-hot	94.2611	0.1387	13.0752	(267)
Energy for lighting	113.2174	0.1443	16.3408	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-327.4788	0.1322	-43.2819	
PV Unit electricity exported	-158.2973	0.1234	-19.5414	
Total			-62.8232	(269)
Total CO2, kg/year			266.8745	(272)
CO2 emissions per m2			5.8000	(273)
EI value			96.0698	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		45.9900	(1b)	x 2.4000	(2b) =	110.3760	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.9900						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		110.3760	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.1800	1.2357	8.8726			(27)
External Wall 1	16.0600	7.1800	8.8800	0.1400	1.2432	14.0000	124.3200	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.1158			(33)
Party Wall 1			23.2200	0.0000	0.0000	20.0000	464.4000	(32)
Wall to corridor			39.2800	0.0000	0.0000	20.0000	785.6000	(32)
Party Floor 1			45.9900			80.0000	3679.2000	(32d)
Party Ceiling 1			45.9900			80.0000	3679.2000	(32b)
Internal Wall 1			66.6300			9.0000	599.6700	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9332.3900 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 202.9222 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4	Jamb	9.2800	0.0500	0.4640
E7	Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165
E18	Party wall between dwellings	2.7000	0.0600	0.1620
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.2120 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 11.3278 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	10.6040	10.6040	10.3922	9.7571	9.6512	9.2278	9.0161	9.0161	9.4395	9.9688	10.1805	10.0747	(38)
Heat transfer coeff	21.9318	21.9318	21.7201	21.0849	20.9791	20.5556	20.3439	20.3439	20.7674	21.2966	21.5084	21.4025	(39)

Average = Sum(39)m / 12 = 21.1555

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4769	0.4769	0.4723	0.4585	0.4562	0.4470	0.4424	0.4424	0.4516	0.4631	0.4677	0.4654	(40)
HLP (average)												0.4600	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.5731 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	69.5673	68.5219	66.9984	64.0836	61.9325	59.5337	58.1702	59.6821	61.3394	63.9151	66.8925	69.3008	(42a)
Hot water usage for baths	21.8805	21.5555	21.0979	20.2542	19.6224	18.9219	18.5435	18.9979	19.4926	20.2422	21.1034	21.8065	(42b)
Hot water usage for other uses	30.7397	29.6219	28.5041	27.3863	26.2684	25.1506	25.1506	26.2684	27.3863	28.5041	29.6219	30.7397	(42c)

Average daily hot water use (litres/day) 112.3706 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	122.1875	119.6993	116.6004	111.7240	107.8234	103.6062	101.8643	104.9484	108.2183	112.6614	117.6177	121.8470	(44)
Energy conte	193.5151	170.4502	179.2105	152.9446	145.1510	127.3959	123.1960	129.9480	133.4440	152.8804	167.5680	190.7830	(45)
Energy content (annual)										Total = Sum(45)m =		1866.4867	
Distribution loss (46)m = 0.15 x (45)m	29.0273	25.5675	26.8816	22.9417	21.7726	19.1094	18.4794	19.4922	20.0166	22.9321	25.1352	28.6174	(46)

Water storage loss:

Store volume 143.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)

Temperature factor from Table 2b 0.6000 (49)

Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(64)
									Total per year (kWh/year) = Sum(64)m =			2113.5187	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	81.1284	71.8350	76.3721	67.0973	65.0473	58.6023	57.7473	59.9924	60.6133	67.6174	71.9596	80.2200	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.0271	14.2351	11.5768	8.7644	6.5515	5.5310	5.9765	7.7684	10.4268	13.2392	15.4521	16.4725	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	204.2328	206.3521	201.0115	189.6421	175.2902	161.8015	152.7902	150.6709	156.0115	167.3809	181.7328	195.2215	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	(71)
Water heating gains (Table 5)													
	109.0436	106.8973	102.6507	93.1907	87.4292	81.3921	77.6173	80.6349	84.1852	90.8836	99.9438	107.8225	(72)
Total internal gains													
	406.7760	404.9571	392.7115	369.0697	346.7435	326.1972	313.8566	316.5468	328.0960	348.9762	374.6012	396.9891	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.1800	33.4622	0.6300	0.8270	0.7700	86.7478	(79)

Solar gains	86.7478	157.7089	225.5139	293.9220	325.8839	314.4382	306.9161	273.5144	241.9971	173.2574	106.7816	75.9203	(83)
Total gains	493.5238	562.6659	618.2254	662.9917	672.6273	640.6354	620.7726	590.0612	570.0931	522.2336	481.3828	472.9094	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	118.1997	118.1997	119.3519	122.9471	123.5675	126.1129	127.4253	127.4253	124.8272	121.7249	120.5267	121.1228	
alpha	8.8800	8.8800	8.9568	9.1965	9.2378	9.4075	9.4950	9.4950	9.3218	9.1150	9.0351	9.0749	
util living area													
	0.7428	0.6458	0.5400	0.4165	0.3212	0.2503	0.1999	0.2138	0.2987	0.4606	0.6391	0.7628	(86)
MIT	20.9731	20.9908	20.9980	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9996	20.9933	20.9694	(87)
Th 2	20.5421	20.5421	20.5463	20.5590	20.5612	20.5697	20.5740	20.5740	20.5654	20.5548	20.5506	20.5527	(88)
util rest of house													
	0.7256	0.6290	0.5243	0.4025	0.3076	0.2365	0.1859	0.1991	0.2829	0.4425	0.6200	0.7461	(89)
MIT 2	20.5139	20.5327	20.5443	20.5589	20.5612	20.5697	20.5740	20.5740	20.5654	20.5545	20.5440	20.5204	(90)
Living area fraction										fLA = Living area / (4) =		0.5849	(91)
MIT	20.7824	20.8007	20.8097	20.8168	20.8178	20.8214	20.8232	20.8232	20.8196	20.8149	20.8068	20.7830	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7824	20.8007	20.8097	20.8168	20.8178	20.8214	20.8232	20.8232	20.8196	20.8149	20.8068	20.7830	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7347	0.6386	0.5335	0.4107	0.3156	0.2445	0.1941	0.2077	0.2921	0.4531	0.6309	0.7548	(94)
Useful gains	362.6064	359.2916	329.7927	272.3050	212.2593	156.6621	120.5001	122.5345	166.5448	236.6137	303.7082	356.9401	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	370.2621	361.8891	330.3553	272.3499	212.2627	156.6623	120.5001	122.5345	166.5461	236.7092	305.5653	365.6195	(97)
Space heating kWh													
	5.6959	1.7455	0.4185	0.0323	0.0025	0.0000	0.0000	0.0000	0.0000	0.0710	1.3371	6.4575	(98a)
Space heating requirement - total per year (kWh/year)												15.7604	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	5.6959	1.7455	0.4185	0.0323	0.0025	0.0000	0.0000	0.0000	0.0000	0.0710	1.3371	6.4575	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												15.7604	
Space heating per m2										(98c) / (4) =		0.3427	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	5.6959	1.7455	0.4185	0.0323	0.0025	0.0000	0.0000	0.0000	0.0000	0.0710	1.3371	6.4575	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	5.6959	1.7455	0.4185	0.0323	0.0025	0.0000	0.0000	0.0000	0.0000	0.0710	1.3371	6.4575	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.0057	7.2310	8.0057	7.7475	8.0057	7.7475	8.0057	8.0057	7.7475	8.0057	7.7475	8.0057	(231)

Lighting	14.0284	11.2541	10.1331	7.4239	5.7345	4.6851	5.2312	6.7997	8.8321	11.5882	13.0888	14.4183	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-9.8663	-16.7384	-28.5043	-37.7924	-44.3586	-41.9198	-41.6208	-36.6000	-29.5382	-20.6033	-11.7348	-8.4781	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.7887	-4.5720	-10.7677	-19.3145	-26.7545	-26.4809	-26.5266	-20.5284	-13.8216	-6.8398	-2.5820	-1.4202	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	15.7604	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2113.5187	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	94.2611	(230a)
Total electricity for the above, kWh/year	94.2611	(231)
Electricity for lighting (calculated in Appendix L)	113.2174	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-489.1519	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1847.6057	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	15.7604	25.1600	3.9653	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2113.5187	25.1600	531.7613	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	94.2611	25.1600	23.7161	(249)
Energy for lighting	113.2174	25.1600	28.4855	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-327.7550	25.1600	-82.4632	
PV Unit electricity exported	-161.3969	5.8100	-9.3772	
Total			-91.8403	(252)
Total energy cost			496.0879	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	15.7604	0.1612	2.5408	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2113.5187	0.1412	298.5203	(264)
Space and water heating			301.0612	(265)
Pumps, fans and electric keep-hot	94.2611	0.1387	13.0752	(267)
Energy for lighting	113.2174	0.1443	16.3408	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-327.7550	0.1319	-43.2162	
PV Unit electricity exported	-161.3969	0.1230	-19.8470	
Total			-63.0633	(269)
Total CO2, kg/year			267.4138	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	15.7604	1.5966	25.1627	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2113.5187	1.5223	3217.3749	(278)
Space and water heating			3242.5376	(279)
Pumps, fans and electric keep-hot	94.2611	1.5128	142.5982	(281)
Energy for lighting	113.2174	1.5338	173.6566	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-327.7550	1.4872	-487.4259	
PV Unit electricity exported	-161.3969	0.4513	-72.8380	
Total			-560.2639	(283)
Total Primary energy kWh/year			2998.5286	(286)

SAP 10 EPC IMPROVEMENTS

Unit 72 L04_Copy

Current energy efficiency rating: C 79
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 79
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£588	£588	£0
Space heating	£28	£28	£0
Water heating	£532	£532	£0
Lighting	£28	£28	£0
Generated (PV)	-£92	-£92	£0
Total cost of fuels	£496	£496	£0
Total cost of uses	£496	£496	£0
Delivered energy	40 kWh/m²	40 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	65 kWh/m²	65 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.9900 (1b)	x	2.4000 (2b)	=	110.3760	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.9900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	110.3760	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.1800	1.2357	8.8726			(27)
External Wall 1	16.0600	7.1800	8.8800	0.1400	1.2432	14.0000	124.3200	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	10.1158			(33)
Party Wall 1			23.2200	0.0000	0.0000	20.0000	464.4000	(32)
Wall to corridor			39.2800	0.0000	0.0000	20.0000	785.6000	(32)
Party Floor 1			45.9900			80.0000	3679.2000	(32d)
Party Ceiling 1			45.9900			80.0000	3679.2000	(32b)
Internal Wall 1			66.6300			9.0000	599.6700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9332.3900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.9222 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165
E18 Party wall between dwellings	2.7000	0.0600	0.1620
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.2120 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	11.3278 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	10.4981	10.3922	10.2864	9.7571	9.6512	9.1220	9.1220	9.0161	9.3337	9.6512	9.8630	10.0747	(38)
Heat transfer coeff	21.8259	21.7201	21.6142	21.0849	20.9791	20.4498	20.4498	20.3439	20.6615	20.9791	21.1908	21.4025	(39)
Average = Sum(39)m / 12 =												21.0585	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4746	0.4723	0.4700	0.4585	0.4562	0.4447	0.4447	0.4424	0.4493	0.4562	0.4608	0.4654	(40)
HLP (average)												0.4579	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.5731 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
69.5673	68.5219	66.9984	64.0836	61.9325	59.5337	58.1702	59.6821	61.3394	63.9151	66.8925	69.3008	(42a)

Hot water usage for baths

21.8805	21.5555	21.0979	20.2542	19.6224	18.9219	18.5435	18.9979	19.4926	20.2422	21.1034	21.8065	(42b)

Hot water usage for other uses

30.7397	29.6219	28.5041	27.3863	26.2684	25.1506	25.1506	26.2684	27.3863	28.5041	29.6219	30.7397	(42c)

Average daily hot water use (litres/day)		112.3706 (43)

Daily hot water use

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
122.1875	119.6993	116.6004	111.7240	107.8234	103.6062	101.8643	104.9484	108.2183	112.6614	117.6177	121.8470	(44)
Energy conte 193.5151	170.4502	179.2105	152.9446	145.1510	127.3959	123.1960	129.9480	133.4440	152.8804	167.5680	190.7830	(45)

Energy content (annual)	Total = Sum(45)m =	1866.4867

Distribution loss (46)m = 0.15 x (45)m

29.0273	25.5675	26.8816	22.9417	21.7726	19.1094	18.4794	19.4922	20.0166	22.9321	25.1352	28.6174	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(64)

	Total per year (kWh/year) = Sum(64)m =	2113.5187 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000 (64a)

Heat gains from water heating, kWh/month

81.1284	71.8350	76.3721	67.0973	65.0473	58.6023	57.7473	59.9924	60.6133	67.6174	71.9596	80.2200	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m 94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

16.0271	14.2351	11.5768	8.7644	6.5515	5.5310	5.9765	7.7684	10.4268	13.2392	15.4521	16.4725	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

204.2328	206.3521	201.0115	189.6421	175.2902	161.8015	152.7902	150.6709	156.0115	167.3809	181.7328	195.2215	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	(71)

Water heating gains (Table 5)

109.0436	106.8973	102.6507	93.1907	87.4292	81.3921	77.6173	80.6349	84.1852	90.8836	99.9438	107.8225	(72)

Total internal gains

406.7760	404.9571	392.7115	369.0697	346.7435	326.1972	313.8566	316.5468	328.0960	348.9762	374.6012	396.9891	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.1800	36.7938	0.6300	0.8270	0.7700	95.3847	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	95.3847	162.4755	222.3060	275.4479	308.5246	306.2935	295.2996	270.6229	240.7104	179.5700	114.2489	81.6294	(83)
Total gains	502.1607	567.4325	615.0175	644.5176	655.2681	632.4907	609.1562	587.1697	568.8063	528.5462	488.8501	478.6185	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	118.7730	119.3519	119.9364	122.9471	123.5675	126.7657	126.7657	127.4253	125.4668	123.5675	122.3329	121.1228	
alpha	8.9182	8.9568	8.9958	9.1965	9.2378	9.4510	9.4510	9.4950	9.3645	9.2378	9.1555	9.0749	
util living area	0.7139	0.6132	0.5090	0.3958	0.2977	0.2069	0.1477	0.1594	0.2506	0.4127	0.6002	0.7365	(86)
MIT	20.9808	20.9943	20.9989	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9999	20.9963	20.9773	(87)
Th 2	20.5442	20.5463	20.5484	20.5590	20.5612	20.5718	20.5718	20.5740	20.5676	20.5612	20.5569	20.5527	(88)
util rest of house	0.6964	0.5965	0.4933	0.3814	0.2837	0.1931	0.1333	0.1446	0.2349	0.3953	0.5816	0.7193	(89)
MIT 2	20.5244	20.5406	20.5473	20.5590	20.5612	20.5718	20.5718	20.5740	20.5676	20.5611	20.5534	20.5290	(90)
Living area fraction									fLA = Living area / (4) =			0.5849	(91)
MIT	20.7914	20.8060	20.8114	20.8169	20.8178	20.8223	20.8223	20.8232	20.8205	20.8177	20.8125	20.7912	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7914	20.8060	20.8114	20.8169	20.8178	20.8223	20.8223	20.8232	20.8205	20.8177	20.8125	20.7912	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7060	0.6060	0.5024	0.3898	0.2919	0.2012	0.1417	0.1533	0.2441	0.4055	0.5923	0.7285	(94)
Useful gains	354.5074	343.8804	309.0123	251.2398	191.2823	127.2439	86.3444	89.9842	138.8553	214.3281	289.5660	348.6732	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	359.9391	345.4791	309.3302	251.2663	191.2838	127.2440	86.3444	89.9842	138.8555	214.3586	290.5780	355.0941	(97)
Space heating kWh	4.0412	1.0743	0.2365	0.0191	0.0012	0.0000	0.0000	0.0000	0.0000	0.0227	0.7287	4.7771	(98a)
Space heating requirement - total per year (kWh/year)												10.9008	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	4.0412	1.0743	0.2365	0.0191	0.0012	0.0000	0.0000	0.0000	0.0000	0.0227	0.7287	4.7771	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												10.9008	
Space heating per m2										(98c) / (4) =		0.2370	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	4.0412	1.0743	0.2365	0.0191	0.0012	0.0000	0.0000	0.0000	0.0000	0.0227	0.7287	4.7771	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	4.0412	1.0743	0.2365	0.0191	0.0012	0.0000	0.0000	0.0000	0.0000	0.0227	0.7287	4.7771	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.0057	7.2310	8.0057	7.7475	8.0057	7.7475	8.0057	8.0057	7.7475	8.0057	7.7475	8.0057	(231)
Lighting	14.0284	11.2541	10.1331	7.4239	5.7345	4.6851	5.2312	6.7997	8.8321	11.5882	13.0888	14.4183	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.8993	-17.4078	-28.5102	-36.2313	-42.8143	-41.3038	-40.6546	-36.5886	-29.7380	-21.5191	-12.6327	-9.1789	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.1048	-4.8851	-10.7752	-17.9137	-25.0663	-25.7620	-25.3918	-20.5168	-13.9872	-7.3627	-2.9149	-1.6169	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												10.9008	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2113.5187	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	94.2611	(230a)
Total electricity for the above, kWh/year	94.2611	(231)
Electricity for lighting (calculated in Appendix L)	113.2174	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-485.7761	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1846.1219	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	10.9008	16.4900	1.7975	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2113.5187	16.4900	348.5192	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	94.2611	16.4900	15.5437	(249)
Energy for lighting	113.2174	16.4900	18.6696	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-327.4788	16.4900	-54.0013	
PV Unit electricity exported	-158.2973	5.5900	-8.8488	
Total			-62.8501	(252)
Total energy cost			321.6799	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2727	(257)
SAP value		79.3692	
SAP rating (Section 12)		79	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	10.9008	0.1616	1.7615	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2113.5187	0.1412	298.5203	(264)
Space and water heating			300.2818	(265)
Pumps, fans and electric keep-hot	94.2611	0.1387	13.0752	(267)
Energy for lighting	113.2174	0.1443	16.3408	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-327.4788	0.1322	-43.2819	
PV Unit electricity exported	-158.2973	0.1234	-19.5414	
Total			-62.8232	(269)
Total CO2, kg/year			266.8745	(272)
CO2 emissions per m2			5.8000	(273)
EI value			96.0698	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.9900	(1b)	x 2.4000	(2b)	= 110.3760	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 45.9900						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)		= 110.3760	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 = 0.0000	(6a)
Number of open flues	0 * 20 = 0.0000	(6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.1800	1.2357	8.8726			(27)
External Wall 1	16.0600	7.1800	8.8800	0.1400	1.2432	14.0000	124.3200	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	10.1158			(33)
Party Wall 1			23.2200	0.0000	0.0000	20.0000	464.4000	(32)
Wall to corridor			39.2800	0.0000	0.0000	20.0000	785.6000	(32)
Party Floor 1			45.9900			80.0000	3679.2000	(32d)
Party Ceiling 1			45.9900			80.0000	3679.2000	(32b)
Internal Wall 1			66.6300			9.0000	599.6700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 9332.3900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	202.9222 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165
E18 Party wall between dwellings	2.7000	0.0600	0.1620
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	1.2120 (36)
Point Thermal bridges	(36a) = 0.0000
Total fabric heat loss	(33) + (36) + (36a) = 11.3278 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	10.6040	10.6040	10.3922	9.7571	9.6512	9.2278	9.0161	9.0161	9.4395	9.9688	10.1805	10.0747	(38)
Heat transfer coeff	21.9318	21.9318	21.7201	21.0849	20.9791	20.5556	20.3439	20.3439	20.7674	21.2966	21.5084	21.4025	(39)
Average = Sum(39)m / 12 =												21.1555	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4769	0.4769	0.4723	0.4585	0.4562	0.4470	0.4424	0.4424	0.4516	0.4631	0.4677	0.4654	(40)
HLP (average)												0.4600	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.5731 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	69.5673	68.5219	66.9984	64.0836	61.9325	59.5337	58.1702	59.6821	61.3394	63.9151	66.8925	69.3008	(42a)
Hot water usage for baths	21.8805	21.5555	21.0979	20.2542	19.6224	18.9219	18.5435	18.9979	19.4926	20.2422	21.1034	21.8065	(42b)
Hot water usage for other uses	30.7397	29.6219	28.5041	27.3863	26.2684	25.1506	25.1506	26.2684	27.3863	28.5041	29.6219	30.7397	(42c)
Average daily hot water use (litres/day)												112.3706	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	122.1875	119.6993	116.6004	111.7240	107.8234	103.6062	101.8643	104.9484	108.2183	112.6614	117.6177	121.8470	(44)
Energy conte	193.5151	170.4502	179.2105	152.9446	145.1510	127.3959	123.1960	129.9480	133.4440	152.8804	167.5680	190.7830	(45)
Energy content (annual)											Total = Sum(45)m =	1866.4867	
Distribution loss (46)m = 0.15 x (45)m	29.0273	25.5675	26.8816	22.9417	21.7726	19.1094	18.4794	19.4922	20.0166	22.9321	25.1352	28.6174	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(64)
									Total per year (kWh/year) = Sum(64)m =			2113.5187	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	81.1284	71.8350	76.3721	67.0973	65.0473	58.6023	57.7473	59.9924	60.6133	67.6174	71.9596	80.2200	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.0271	14.2351	11.5768	8.7644	6.5515	5.5310	5.9765	7.7684	10.4268	13.2392	15.4521	16.4725	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	204.2328	206.3521	201.0115	189.6421	175.2902	161.8015	152.7902	150.6709	156.0115	167.3809	181.7328	195.2215	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	(71)
Water heating gains (Table 5)	109.0436	106.8973	102.6507	93.1907	87.4292	81.3921	77.6173	80.6349	84.1852	90.8836	99.9438	107.8225	(72)
Total internal gains	406.7760	404.9571	392.7115	369.0697	346.7435	326.1972	313.8566	316.5468	328.0960	348.9762	374.6012	396.9891	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.1800	33.4622	0.6300	0.8270	0.7700	86.7478	(79)

Solar gains	86.7478	157.7089	225.5139	293.9220	325.8839	314.4382	306.9161	273.5144	241.9971	173.2574	106.7816	75.9203	(83)
Total gains	493.5238	562.6659	618.2254	662.9917	672.6273	640.6354	620.7726	590.0612	570.0931	522.2336	481.3828	472.9094	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	118.1997	118.1997	119.3519	122.9471	123.5675	126.1129	127.4253	127.4253	124.8272	121.7249	120.5267	121.1228	
alpha	8.8800	8.8800	8.9568	9.1965	9.2378	9.4075	9.4950	9.4950	9.3218	9.1150	9.0351	9.0749	
util living area	0.7428	0.6458	0.5400	0.4165	0.3212	0.2503	0.1999	0.2138	0.2987	0.4606	0.6391	0.7628	(86)
MIT	20.9731	20.9908	20.9980	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9996	20.9933	20.9694	(87)
Th 2	20.5421	20.5421	20.5463	20.5590	20.5612	20.5697	20.5740	20.5740	20.5654	20.5548	20.5506	20.5527	(88)
util rest of house	0.7256	0.6290	0.5243	0.4025	0.3076	0.2365	0.1859	0.1991	0.2829	0.4425	0.6200	0.7461	(89)
MIT 2	20.5139	20.5327	20.5443	20.5589	20.5612	20.5697	20.5740	20.5740	20.5654	20.5545	20.5440	20.5204	(90)
Living area fraction										fLA = Living area / (4) =		0.5849	(91)
MIT	20.7824	20.8007	20.8097	20.8168	20.8178	20.8214	20.8232	20.8232	20.8196	20.8149	20.8068	20.7830	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7824	20.8007	20.8097	20.8168	20.8178	20.8214	20.8232	20.8232	20.8196	20.8149	20.8068	20.7830	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7347	0.6386	0.5335	0.4107	0.3156	0.2445	0.1941	0.2077	0.2921	0.4531	0.6309	0.7548	(94)
Useful gains	362.6064	359.2916	329.7927	272.3050	212.2593	156.6621	120.5001	122.5345	166.5448	236.6137	303.7082	356.9401	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	370.2621	361.8891	330.3553	272.3499	212.2627	156.6623	120.5001	122.5345	166.5461	236.7092	305.5653	365.6195	(97)
Space heating kWh	5.6959	1.7455	0.4185	0.0323	0.0025	0.0000	0.0000	0.0000	0.0000	0.0710	1.3371	6.4575	(98a)
Space heating requirement - total per year (kWh/year)												15.7604	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	5.6959	1.7455	0.4185	0.0323	0.0025	0.0000	0.0000	0.0000	0.0000	0.0710	1.3371	6.4575	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												15.7604	
Space heating per m2											(98c) / (4) =	0.3427	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	5.6959	1.7455	0.4185	0.0323	0.0025	0.0000	0.0000	0.0000	0.0000	0.0710	1.3371	6.4575	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													

	5.6959	1.7455	0.4185	0.0323	0.0025	0.0000	0.0000	0.0000	0.0000	0.0710	1.3371	6.4575 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	8.0057	7.2310	8.0057	7.7475	8.0057	7.7475	8.0057	8.0057	7.7475	8.0057	7.7475	8.0057 (231)
Lighting	14.0284	11.2541	10.1331	7.4239	5.7345	4.6851	5.2312	6.7997	8.8321	11.5882	13.0888	14.4183 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-9.8663	-16.7384	-28.5043	-37.7924	-44.3586	-41.9198	-41.6208	-36.6000	-29.5382	-20.6033	-11.7348	-8.4781 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-1.7887	-4.5720	-10.7677	-19.3145	-26.7545	-26.4809	-26.5266	-20.5284	-13.8216	-6.8398	-2.5820	-1.4202 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	15.7604 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2113.5187 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	94.2611 (230a)
Total electricity for the above, kWh/year	94.2611 (231)
Electricity for lighting (calculated in Appendix L)	113.2174 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-489.1519 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1847.6057 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	15.7604	25.1600	3.9653	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2113.5187	25.1600	531.7613	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	94.2611	25.1600	23.7161	(249)
Energy for lighting	113.2174	25.1600	28.4855	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-327.7550	25.1600	-82.4632	
PV Unit electricity exported	-161.3969	5.8100	-9.3772	
Total			-91.8403	(252)
Total energy cost			496.0879	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	15.7604	0.1612	2.5408	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2113.5187	0.1412	298.5203	(264)
Space and water heating			301.0612	(265)
Pumps, fans and electric keep-hot	94.2611	0.1387	13.0752	(267)
Energy for lighting	113.2174	0.1443	16.3408	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-327.7550	0.1319	-43.2162	
PV Unit electricity exported	-161.3969	0.1230	-19.8470	
Total			-63.0633	(269)
Total CO2, kg/year			267.4138	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	15.7604	1.5966	25.1627	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2113.5187	1.5223	3217.3749	(278)
Space and water heating			3242.5376	(279)

Pumps, fans and electric keep-hot	94.2611	1.5128	142.5982 (281)
Energy for lighting	113.2174	1.5338	173.6566 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-327.7550	1.4872	-487.4259
PV Unit electricity exported	-161.3969	0.4513	-72.8380
Total			-560.2639 (283)
Total Primary energy kWh/year			2998.5286 (286)

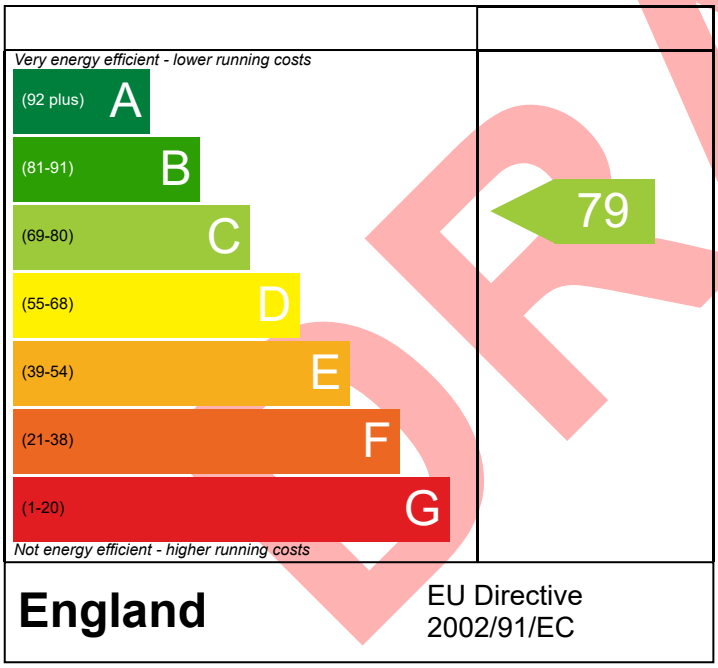
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	45.99 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

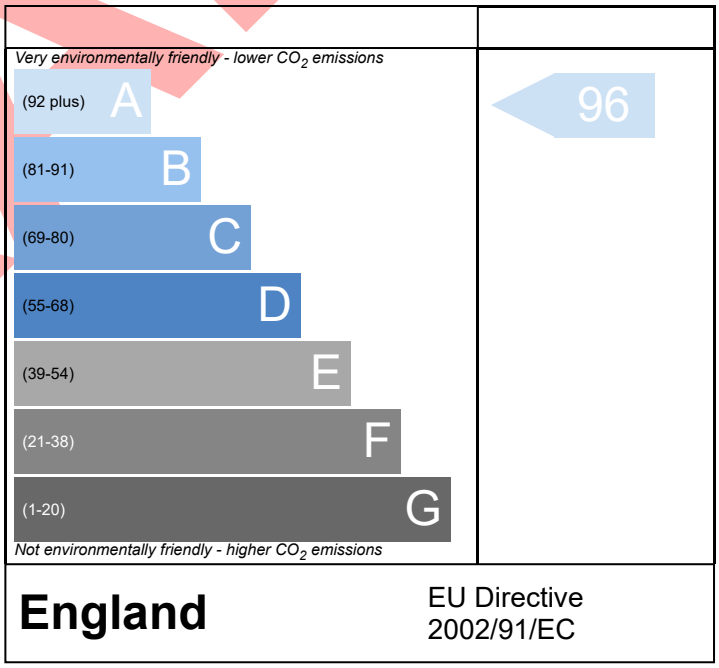
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:45

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	71 m^2
Site Reference	Unit 73 L04_Copy	Plot Reference	Unit 73 L04_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*9.51 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	4.43 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*51.39 kWh$_{PE}$/m^2*	
Dwelling primary energy	50.5 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*14.0 kWh/m^2*	
Dwelling fabric energy efficiency	12.9 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	11	0.14 **(!)**
Party wall: Party Wall (1)	52.62	0 **(!)**
Party wall: Party Wall (2)	15.55	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	11.81	South West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.92 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 73 L04_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 73 L04_Copy	**Prop Type Ref**	Unit 73 L04
Property			

SAP Rating	81 B	**DER**	4.43	**TER**	9.51
Environmental	96 A	**% DER < TER**			53.42
CO_2 Emissions (t/year)	0.31	**DFEE**	12.95	**TFEE**	14.02
Compliance Check	See BREL	**% DFEE < TFEE**			7.68
% DPER < TPER	1.73	**DPER**	50.50	**TPER**	51.39

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

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2. Ventilation rate

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	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			136.8900			9.0000	1232.0100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14106.2100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		198.7350 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545

E4 Jamb	13.9200	0.0500	0.6960	
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.8660 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.2026	16.0392	15.8758	15.0589	14.8955	14.0786	14.0786	13.9153	14.4054	14.8955	15.2223	15.5490	(38)
Heat transfer coeff	34.2027	34.0393	33.8759	33.0590	32.8956	32.0787	32.0787	31.9154	32.4055	32.8956	33.2224	33.5491	(39)

Average = Sum(39)m / 12 = 33.0182

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4819	0.4796	0.4773	0.4658	0.4634	0.4519	0.4519	0.4496	0.4565	0.4634	0.4681	0.4727	(40)
HLP (average)												0.4652	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2697 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day) 138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)

Energy content (annual) Total = Sum(45)m = 2297.5146

Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)

Total per year (kWh/year) = Sum(64)m = 2544.5466 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	11.8100	36.7938	0.6300	0.8270	0.7700	156.8932	(79)

Solar gains	156.8932	267.2472	365.6593	453.0696	507.4757	503.8059	485.7227	445.1333	395.9317	295.3651	187.9219	134.2679	(83)
Total gains	703.2397	811.4507	893.0014	948.1177	971.2994	939.0493	903.8213	866.4472	833.2498	761.5780	689.4197	666.6128	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.5640	115.1138	115.6690	118.5272	119.1159	122.1492	122.1492	122.7745	120.9175	119.1159	117.9443	116.7956	
alpha	8.6376	8.6743	8.7113	8.9018	8.9411	9.1433	9.1433	9.1850	9.0612	8.9411	8.8630	8.7864	
util living area													
	0.7830	0.6679	0.5487	0.4218	0.3150	0.2186	0.1562	0.1694	0.2683	0.4490	0.6634	0.8084	(86)
MIT	20.9566	20.9872	20.9974	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9997	20.9906	20.9478	(87)
Th 2	20.5375	20.5396	20.5417	20.5523	20.5544	20.5651	20.5651	20.5672	20.5608	20.5544	20.5502	20.5460	(88)
util rest of house													
	0.7656	0.6501	0.5316	0.4062	0.2999	0.2038	0.1407	0.1535	0.2513	0.4298	0.6432	0.7918	(89)
MIT 2	20.4917	20.5266	20.5392	20.5521	20.5544	20.5651	20.5651	20.5672	20.5608	20.5542	20.5409	20.4903	(90)
Living area fraction										fLA = Living area / (4) =		0.4060	(91)
MIT	20.6805	20.7136	20.7253	20.7339	20.7353	20.7417	20.7417	20.7429	20.7391	20.7351	20.7235	20.6760	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6805	20.7136	20.7253	20.7339	20.7353	20.7417	20.7417	20.7429	20.7391	20.7351	20.7235	20.6760	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7711	0.6569	0.5385	0.4125	0.3060	0.2098	0.1470	0.1600	0.2582	0.4376	0.6510	0.7967	(94)
Useful gains	542.2498	533.0331	480.8626	391.1295	297.2181	197.0170	132.8596	138.6063	215.1439	333.2833	448.8144	531.0779	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	560.2549	538.2843	481.8939	391.2164	297.2233	197.0171	132.8596	138.6064	215.1447	333.3996	452.6050	552.7564	(97)
Space heating kWh													
	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(98a)
Space heating requirement - total per year (kWh/year)												36.7029	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												36.7029	
Space heating per m2											(98c) / (4) =	0.5171	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)
Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.7495	-26.5603	-43.1928	-54.4883	-64.0200	-61.6099	-60.6290	-54.7463	-44.7493	-32.6607	-19.3354	-14.1254	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.5280	-8.2015	-18.0659	-29.9413	-41.8277	-42.9674	-42.3587	-34.2994	-23.4325	-12.3753	-4.9084	-2.7087	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	36.7029	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2544.5466	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	154.2094	(230a)
Total electricity for the above, kWh/year	154.2094	(231)
Electricity for lighting (calculated in Appendix L)	163.7369	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-757.4814	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2141.7144	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	36.7029	16.4900	6.0523	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	16.4900	419.5957	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	16.4900	25.4291	(249)
Energy for lighting	163.7369	16.4900	27.0002	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-492.8668	16.4900	-81.2737	
PV Unit electricity exported	-264.6146	5.5900	-14.7920	
Total			-96.0657	(252)
Total energy cost			382.0117	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1858	(257)
SAP value		80.7789	
SAP rating (Section 12)		81	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	36.7029	0.1615	5.9279	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			365.4724	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-492.8668	0.1323	-65.2087	
PV Unit electricity exported	-264.6146	0.1235	-32.6780	
Total			-97.8867	(269)
Total CO2, kg/year			312.6088	(272)
CO2 emissions per m2			4.4000	(273)
EI value			96.3882	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			136.8900			9.0000	1232.0100	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14106.2100 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 198.7350 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.8660 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3659	16.3659	16.0392	15.0589	14.8955	14.2420	13.9153	13.9153	14.5688	15.3857	15.7124	15.5490	(38)
Heat transfer coeff	34.3660	34.3660	34.0393	33.0590	32.8956	32.2421	31.9154	31.9154	32.5689	33.3858	33.7125	33.5491	(39)

Average = Sum(39)m / 12 = 33.1679

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4842	0.4842	0.4796	0.4658	0.4634	0.4542	0.4496	0.4496	0.4588	0.4704	0.4750	0.4727	(40)
HLP (average)												0.4673	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2697 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day) 138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:

Store volume 143.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)

Temperature factor from Table 2b 0.6000 (49)

Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
										Total per year (kWh/year) = Sum(64)m =		2544.5466	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)													
	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains													
	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	11.8100	33.4622	0.6300	0.8270	0.7700	142.6869	(79)

Solar gains	142.6869	259.4069	370.9357	483.4567	536.0291	517.2027	504.8299	449.8893	398.0481	284.9819	175.6394	124.8772	(83)
Total gains	689.0334	803.6104	898.2779	978.5047	999.8527	952.4462	922.9286	871.2033	835.3662	751.1948	677.1372	657.2222	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.0193	114.0193	115.1138	118.5272	119.1159	121.5302	122.7745	122.7745	120.3109	117.3671	116.2296	116.7956	
alpha	8.6013	8.6013	8.6743	8.9018	8.9411	9.1020	9.1850	9.1850	9.0207	8.8245	8.7486	8.7864	
util living area													
	0.8121	0.7024	0.5813	0.4424	0.3389	0.2640	0.2109	0.2271	0.3197	0.5016	0.7054	0.8339	(86)
MIT	20.9408	20.9801	20.9957	20.9996	21.0000	21.0000	21.0000	21.0000	21.0000	20.9991	20.9836	20.9316	(87)
Th 2	20.5354	20.5354	20.5396	20.5523	20.5544	20.5630	20.5672	20.5672	20.5587	20.5481	20.5438	20.5460	(88)
util rest of house													
	0.7957	0.6848	0.5643	0.4273	0.3242	0.2492	0.1960	0.2113	0.3025	0.4817	0.6853	0.8185	(89)
MIT 2	20.4720	20.5147	20.5353	20.5520	20.5544	20.5630	20.5672	20.5672	20.5587	20.5473	20.5274	20.4721	(90)
Living area fraction										fLA = Living area / (4) =		0.4060	(91)
MIT	20.6623	20.7037	20.7222	20.7337	20.7353	20.7404	20.7429	20.7429	20.7379	20.7307	20.7126	20.6587	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6623	20.7037	20.7222	20.7337	20.7353	20.7404	20.7429	20.7429	20.7379	20.7307	20.7126	20.6587	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8002	0.6912	0.5711	0.4334	0.3302	0.2553	0.2021	0.2177	0.3095	0.4898	0.6928	0.8224	(94)
Useful gains	551.3951	555.4826	512.9858	424.1297	330.1075	243.1179	186.4793	189.6708	258.5229	367.9207	469.1053	540.4930	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	576.0546	563.7301	514.7494	424.2710	330.1185	243.1186	186.4794	189.6709	258.5275	368.2690	475.7715	568.9488	(97)
Space heating kWh													
	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711	(98a)
Space heating requirement - total per year (kWh/year)												51.5410	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												51.5410	
Space heating per m2											(98c) / (4) =	0.7261	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)

Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-15.1816	-25.5601	-43.1889	-56.7799	-66.2625	-62.5005	-62.0252	-54.7629	-44.4553	-31.2938	-17.9805	-13.0606 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.9923	-7.6695	-18.0487	-32.2682	-44.6258	-44.1582	-44.2385	-34.3187	-23.1566	-11.4989	-4.3440	-2.3741 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	51.5410 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2544.5466 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	154.2094 (230a)
Total electricity for the above, kWh/year	154.2094 (231)
Electricity for lighting (calculated in Appendix L)	163.7369 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-762.7453 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2151.2886 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	51.5410	25.1600	12.9677	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	25.1600	640.2079	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	25.1600	38.7991	(249)
Energy for lighting	163.7369	25.1600	41.1962	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.0518	25.1600	-124.0518	
PV Unit electricity exported	-269.6935	5.8100	-15.6692	
Total			-139.7210	(252)
Total energy cost			593.4499	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	51.5410	0.1611	8.3045	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			367.8491	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.0518	0.1320	-65.0800	
PV Unit electricity exported	-269.6935	0.1230	-33.1742	
Total			-98.2543	(269)
Total CO2, kg/year			314.6179	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	51.5410	1.5962	82.2716	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	1.5225	3874.0629	(278)
Space and water heating			3956.3345	(279)
Pumps, fans and electric keep-hot	154.2094	1.5128	233.2880	(281)
Energy for lighting	163.7369	1.5338	251.1452	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.0518	1.4877	-733.5071	
PV Unit electricity exported	-269.6935	0.4514	-121.7494	
Total			-855.2565	(283)
Total Primary energy kWh/year			3585.5112	(286)

SAP 10 EPC IMPROVEMENTS

Unit 73 L04_Copy

Current energy efficiency rating: B 81
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: B 81
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£733	£733	£0
Space heating	£52	£52	£0
Water heating	£640	£640	£0
Lighting	£41	£41	£0
Generated (PV)	-£140	-£140	£0
Total cost of fuels	£593	£593	£0
Total cost of uses	£593	£593	£0
Delivered energy	30 kWh/m²	30 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	4 kg/m²	4 kg/m²	0 kg/m²
Primary energy	51 kWh/m²	51 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			136.8900			9.0000	1232.0100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14106.2100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		198.7350 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.8660 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.2026	16.0392	15.8758	15.0589	14.8955	14.0786	14.0786	13.9153	14.4054	14.8955	15.2223	15.5490	(38)
Heat transfer coeff	34.2027	34.0393	33.8759	33.0590	32.8956	32.0787	32.0787	31.9154	32.4055	32.8956	33.2224	33.5491	(39)
Average = Sum(39)m / 12 =												33.0182	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4819	0.4796	0.4773	0.4658	0.4634	0.4519	0.4519	0.4496	0.4565	0.4634	0.4681	0.4727	(40)
HLP (average)												0.4652	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.2697 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)

Hot water usage for baths

26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)

Hot water usage for other uses

37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day)		138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
									Total per year (kWh/year) = Sum(64)m =		2544.5466	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest			11.8100	36.7938	0.6300	0.8270	0.7700	156.8932	(79)
Solar gains	156.8932	267.2472	365.6593	453.0696	507.4757	503.8059	485.7227	445.1333	395.9317	295.3651	187.9219	134.2679	(83)
Total gains	703.2397	811.4507	893.0014	948.1177	971.2994	939.0493	903.8213	866.4472	833.2498	761.5780	689.4197	666.6128	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.5640	115.1138	115.6690	118.5272	119.1159	122.1492	122.1492	122.7745	120.9175	119.1159	117.9443	116.7956	
alpha	8.6376	8.6743	8.7113	8.9018	8.9411	9.1433	9.1433	9.1850	9.0612	8.9411	8.8630	8.7864	
util living area	0.7830	0.6679	0.5487	0.4218	0.3150	0.2186	0.1562	0.1694	0.2683	0.4490	0.6634	0.8084	(86)
MIT	20.9566	20.9872	20.9974	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9997	20.9906	20.9478	(87)
Th 2	20.5375	20.5396	20.5417	20.5523	20.5544	20.5651	20.5651	20.5672	20.5608	20.5544	20.5502	20.5460	(88)
util rest of house	0.7656	0.6501	0.5316	0.4062	0.2999	0.2038	0.1407	0.1535	0.2513	0.4298	0.6432	0.7918	(89)
MIT 2	20.4917	20.5266	20.5392	20.5521	20.5544	20.5651	20.5651	20.5672	20.5608	20.5542	20.5409	20.4903	(90)
Living area fraction									fLA = Living area / (4) =			0.4060	(91)
MIT	20.6805	20.7136	20.7253	20.7339	20.7353	20.7417	20.7417	20.7429	20.7391	20.7351	20.7235	20.6760	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6805	20.7136	20.7253	20.7339	20.7353	20.7417	20.7417	20.7429	20.7391	20.7351	20.7235	20.6760	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7711	0.6569	0.5385	0.4125	0.3060	0.2098	0.1470	0.1600	0.2582	0.4376	0.6510	0.7967	(94)
Useful gains	542.2498	533.0331	480.8626	391.1295	297.2181	197.0170	132.8596	138.6063	215.1439	333.2833	448.8144	531.0779	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	560.2549	538.2843	481.8939	391.2164	297.2233	197.0171	132.8596	138.6064	215.1447	333.3996	452.6050	552.7564	(97)
Space heating kWh	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(98a)
Space heating requirement - total per year (kWh/year)												36.7029	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												36.7029	
Space heating per m2										(98c) / (4) =		0.5171	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)
Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.7495	-26.5603	-43.1928	-54.4883	-64.0200	-61.6099	-60.6290	-54.7463	-44.7493	-32.6607	-19.3354	-14.1254	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.5280	-8.2015	-18.0659	-29.9413	-41.8277	-42.9674	-42.3587	-34.2994	-23.4325	-12.3753	-4.9084	-2.7087	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												36.7029	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2544.5466	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	154.2094	(230a)
Total electricity for the above, kWh/year	154.2094	(231)
Electricity for lighting (calculated in Appendix L)	163.7369	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-757.4814	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2141.7144	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	36.7029	16.4900	6.0523	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	16.4900	419.5957	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	16.4900	25.4291	(249)
Energy for lighting	163.7369	16.4900	27.0002	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-492.8668	16.4900	-81.2737	
PV Unit electricity exported	-264.6146	5.5900	-14.7920	
Total			-96.0657	(252)
Total energy cost			382.0117	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.1858	(257)
SAP value	80.7789	
SAP rating (Section 12)	81	(258)
SAP band	B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	36.7029	0.1615	5.9279	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			365.4724	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-492.8668	0.1323	-65.2087	
PV Unit electricity exported	-264.6146	0.1235	-32.6780	
Total			-97.8867	(269)
Total CO2, kg/year			312.6088	(272)
CO2 emissions per m2			4.4000	(273)
EI value			96.3882	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	70.9800 (1b)	x 2.4000 (2b) =	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 70.9800				(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	170.3520	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 = 0.0000	(6a)
Number of open flues	0 * 20 = 0.0000	(6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			136.8900			9.0000	1232.0100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 14106.2100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.7350 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	1.8660 (36)
Point Thermal bridges (36a) =	0.0000
Total fabric heat loss (33) + (36) + (36a) =	18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3659	16.3659	16.0392	15.0589	14.8955	14.2420	13.9153	13.9153	14.5688	15.3857	15.7124	15.5490	(38)
Heat transfer coeff	34.3660	34.3660	34.0393	33.0590	32.8956	32.2421	31.9154	31.9154	32.5689	33.3858	33.7125	33.5491	(39)
Average = Sum(39)m / 12 =												33.1679	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4842	0.4842	0.4796	0.4658	0.4634	0.4542	0.4496	0.4496	0.4588	0.4704	0.4750	0.4727	(40)
HLP (average)												0.4673	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2697 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)
Average daily hot water use (litres/day)												138.3203	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
									Total per year (kWh/year) = Sum(64)m =			2544.5466	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	11.8100	33.4622	0.6300	0.8270	0.7700	142.6869	(79)

Solar gains	142.6869	259.4069	370.9357	483.4567	536.0291	517.2027	504.8299	449.8893	398.0481	284.9819	175.6394	124.8772	(83)
Total gains	689.0334	803.6104	898.2779	978.5047	999.8527	952.4462	922.9286	871.2033	835.3662	751.1948	677.1372	657.2222	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.0193	114.0193	115.1138	118.5272	119.1159	121.5302	122.7745	122.7745	120.3109	117.3671	116.2296	116.7956	
alpha	8.6013	8.6013	8.6743	8.9018	8.9411	9.1020	9.1850	9.1850	9.0207	8.8245	8.7486	8.7864	
util living area	0.8121	0.7024	0.5813	0.4424	0.3389	0.2640	0.2109	0.2271	0.3197	0.5016	0.7054	0.8339	(86)
MIT	20.9408	20.9801	20.9957	20.9996	21.0000	21.0000	21.0000	21.0000	21.0000	20.9991	20.9836	20.9316	(87)
Th 2	20.5354	20.5354	20.5396	20.5523	20.5544	20.5630	20.5672	20.5672	20.5587	20.5481	20.5438	20.5460	(88)
util rest of house	0.7957	0.6848	0.5643	0.4273	0.3242	0.2492	0.1960	0.2113	0.3025	0.4817	0.6853	0.8185	(89)
MIT 2	20.4720	20.5147	20.5353	20.5520	20.5544	20.5630	20.5672	20.5672	20.5587	20.5473	20.5274	20.4721	(90)
Living area fraction									fLA = Living area / (4) =			0.4060	(91)
MIT	20.6623	20.7037	20.7222	20.7337	20.7353	20.7404	20.7429	20.7429	20.7379	20.7307	20.7126	20.6587	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6623	20.7037	20.7222	20.7337	20.7353	20.7404	20.7429	20.7429	20.7379	20.7307	20.7126	20.6587	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8002	0.6912	0.5711	0.4334	0.3302	0.2553	0.2021	0.2177	0.3095	0.4898	0.6928	0.8224	(94)
Useful gains	551.3951	555.4826	512.9858	424.1297	330.1075	243.1179	186.4793	189.6708	258.5229	367.9207	469.1053	540.4930	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	576.0546	563.7301	514.7494	424.2710	330.1185	243.1186	186.4794	189.6709	258.5275	368.2690	475.7715	568.9488	(97)
Space heating kWh	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711	(98a)
Space heating requirement - total per year (kWh/year)												51.5410	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												51.5410	
Space heating per m2											(98c) / (4) =	0.7261	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													

	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972 (231)
Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-15.1816	-25.5601	-43.1889	-56.7799	-66.2625	-62.5005	-62.0252	-54.7629	-44.4553	-31.2938	-17.9805	-13.0606 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.9923	-7.6695	-18.0487	-32.2682	-44.6258	-44.1582	-44.2385	-34.3187	-23.1566	-11.4989	-4.3440	-2.3741 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	51.5410 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2544.5466 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	154.2094 (230a)
Total electricity for the above, kWh/year	154.2094 (231)
Electricity for lighting (calculated in Appendix L)	163.7369 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-762.7453 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2151.2886 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	51.5410	25.1600	12.9677	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	25.1600	640.2079	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	25.1600	38.7991	(249)
Energy for lighting	163.7369	25.1600	41.1962	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.0518	25.1600	-124.0518	
PV Unit electricity exported	-269.6935	5.8100	-15.6692	
Total			-139.7210	(252)
Total energy cost			593.4499	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	51.5410	0.1611	8.3045	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			367.8491	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.0518	0.1320	-65.0800	
PV Unit electricity exported	-269.6935	0.1230	-33.1742	
Total			-98.2543	(269)
Total CO2, kg/year			314.6179	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	51.5410	1.5962	82.2716	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	1.5225	3874.0629	(278)
Space and water heating			3956.3345	(279)

Pumps, fans and electric keep-hot	154.2094	1.5128	233.2880	(281)
Energy for lighting	163.7369	1.5338	251.1452	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.0518	1.4877	-733.5071	
PV Unit electricity exported	-269.6935	0.4514	-121.7494	
Total			-855.2565	(283)
Total Primary energy kWh/year			3585.5112	(286)

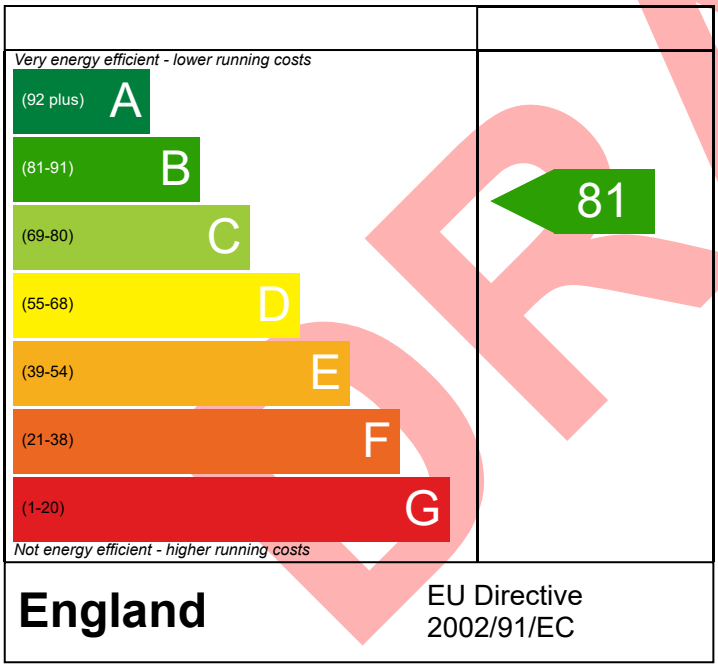
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	70.98 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

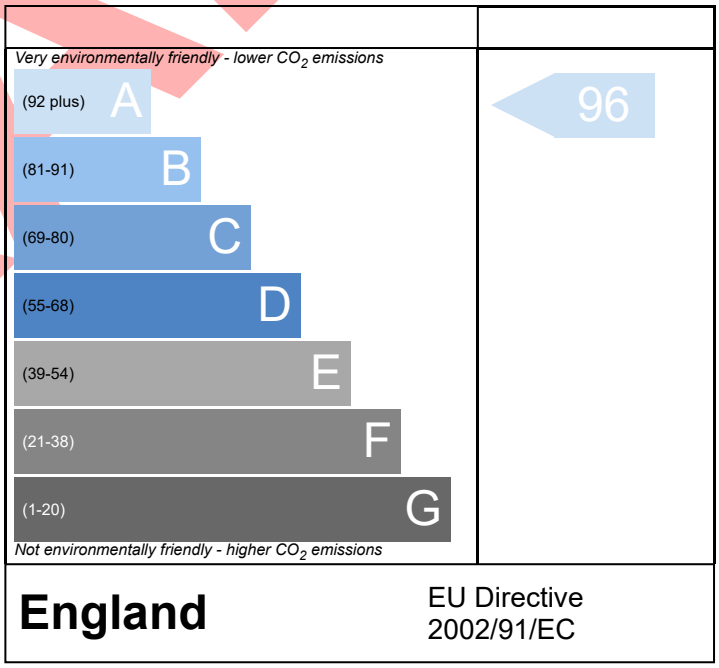
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:45

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	66 m^2
Site Reference	Unit 74 L04_Copy	Plot Reference	Unit 74 L04_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*10.63 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	5.05 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*57.39 kWh$_{PE}$/m^2*	
Dwelling primary energy	56.68 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*19.0 kWh/m^2*	
Dwelling fabric energy efficiency	18.9 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	24.21	0.14 **(!)**
Party wall: Party Wall (1)	55.93	0 **(!)**
Party wall: Party Wall (2)	3.85	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	7.88	South West	0.83	1.3
SE, Opening Type 1	11.81	South East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.86 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 74 L04_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 74 L04_Copy	**Prop Type Ref**	Unit 74 L04
Property			

SAP Rating	79 C	**DER**	5.05	**TER**	10.63
Environmental	96 A	**% DER < TER**			52.49
CO_2 Emissions (t/year)	0.34	**DFEE**	18.93	**TFEE**	19.00
Compliance Check	See BREL	**% DFEE < TFEE**			0.33
% DPER < TPER	1.24	**DPER**	56.68	**TPER**	57.39

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.5000 (1b)	x	2.4000 (2b)	=	159.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.6000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	43.9000	19.6900	24.2100	0.1400	3.3894	14.0000	338.9400	(29a)
Total net area of external elements Aum(A, m2)			43.9000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.7211			(33)
Party Wall 1			55.9300	0.0000	0.0000	20.0000	1118.6000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.5000			80.0000	5320.0000	(32d)
Party Ceiling 1			66.5000			80.0000	5320.0000	(32b)
Internal Wall 1			140.2900			9.0000	1262.6100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13437.1500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.0624 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240

E4 Jamb	23.2000	0.0500	1.1600	
E7 Party floor between dwellings (in blocks of flats)	16.1600	0.0700	1.1312	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	22.1400	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.0392 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 30.7603 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.9354	15.7675	15.5996	14.7602	14.5923	13.7529	13.7529	13.5851	14.0887	14.5923	14.9281	15.2638	(38)
Heat transfer coeff	46.6957	46.5278	46.3600	45.5206	45.3527	44.5133	44.5133	44.3454	44.8490	45.3527	45.6884	46.0242	(39)

Average = Sum(39)m / 12 = 45.4786

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7022	0.6997	0.6971	0.6845	0.6820	0.6694	0.6694	0.6668	0.6744	0.6820	0.6870	0.6921	(40)
HLP (average)												0.6839	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1583 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	83.0588	81.8106	79.9917	76.5116	73.9433	71.0793	69.4513	71.2564	73.2352	76.3103	79.8652	82.7406	(42a)
Hot water usage for baths	26.1000	25.7123	25.1665	24.1600	23.4064	22.5708	22.1194	22.6614	23.2516	24.1458	25.1729	26.0117	(42b)
Hot water usage for other uses	36.7327	35.3969	34.0612	32.7255	31.3897	30.0540	30.0540	31.3897	32.7255	34.0612	35.3969	36.7327	(42c)

Average daily hot water use (litres/day) 134.1695 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.8914	142.9198	139.2194	133.3971	128.7395	123.7040	121.6247	125.3076	129.2122	134.5173	140.4351	145.4849	(44)
Energy conte	231.0563	203.5159	213.9750	182.6139	173.3081	152.1085	147.0945	155.1570	159.3316	182.5387	200.0755	227.7943	(45)

Energy content (annual) Total = Sum(45)m = 2228.5693

Distribution loss (46)m = 0.15 x (45)m	34.6584	30.5274	32.0962	27.3921	25.9962	22.8163	22.0642	23.2735	23.8997	27.3808	30.0113	34.1691	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)

Total per year (kWh/year) = Sum(64)m = 2475.6013 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	93.6109	82.8294	87.9313	76.9623	74.4096	66.8193	65.6936	68.3743	69.2210	77.4788	82.7683	92.5262	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7552	19.3227	15.7143	11.8967	8.8930	7.5078	8.1125	10.5449	14.1533	17.9709	20.9747	22.3598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	282.0814	285.0085	277.6323	261.9291	242.1067	223.4764	211.0302	208.1031	215.4793	231.1825	251.0049	269.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	(71)
Water heating gains (Table 5)	125.8211	123.2580	118.1873	106.8921	100.0129	92.8046	88.2978	91.9010	96.1402	104.1381	114.9560	124.3632	(72)
Total internal gains	522.9304	520.8621	504.8066	473.9908	444.2853	417.0615	400.7133	403.8217	419.0457	446.5643	480.2084	509.6310	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	11.8100	36.7938	0.6300	0.8270	0.7700	156.8932	(77)
Southwest	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(79)

Solar gains	261.5773	445.5629	609.6386	755.3718	846.0793	839.9609	809.8120	742.1401	660.1097	492.4419	313.3093	223.8557	(83)
Total gains	784.5077	966.4250	1114.4452	1229.3625	1290.3646	1257.0225	1210.5252	1145.9618	1079.1553	939.0062	793.5177	733.4867	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	79.9333	80.2217	80.5122	81.9968	82.3004	83.8523	83.8523	84.1698	83.2246	82.3004	81.6955	81.0996	
alpha	6.3289	6.3481	6.3675	6.4665	6.4867	6.5902	6.5902	6.6113	6.5483	6.4867	6.4464	6.4066	
util living area	0.8610	0.7342	0.5934	0.4467	0.3267	0.2266	0.1618	0.1780	0.2867	0.4994	0.7534	0.8867	(86)
MIT	20.7806	20.9169	20.9770	20.9964	20.9996	21.0000	21.0000	21.0000	20.9999	20.9943	20.9214	20.7412	(87)
Th 2	20.3389	20.3411	20.3434	20.3545	20.3568	20.3680	20.3680	20.3702	20.3635	20.3568	20.3523	20.3478	(88)
util rest of house	0.8427	0.7107	0.5685	0.4232	0.3042	0.2042	0.1386	0.1536	0.2603	0.4693	0.7265	0.8706	(89)
MIT 2	20.1020	20.2557	20.3211	20.3513	20.3564	20.3679	20.3680	20.3702	20.3634	20.3519	20.2739	20.0650	(90)
Living area fraction									fLA = Living area / (4) =			0.3370	(91)
MIT	20.3307	20.4785	20.5421	20.5687	20.5732	20.5809	20.5810	20.5824	20.5779	20.5684	20.4921	20.2928	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3307	20.4785	20.5421	20.5687	20.5732	20.5809	20.5810	20.5824	20.5779	20.5684	20.4921	20.2928	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8425	0.7157	0.5761	0.4310	0.3118	0.2118	0.1464	0.1618	0.2692	0.4793	0.7325	0.8692	(94)
Useful gains	660.9362	691.6463	641.9935	529.8378	402.2774	266.2236	177.2049	185.4711	290.4875	450.0389	581.2287	637.5157	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	748.5635	724.8350	650.9921	531.1672	402.4220	266.2311	177.2054	185.4720	290.5269	452.0934	611.8637	740.6597	(97)
Space heating kWh	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(98a)
Space heating requirement - total per year (kWh/year)												195.5822	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												195.5822	
Space heating per m2											(98c) / (4) =	2.9411	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 100.0000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5760	10.4558	11.5760	11.2026	11.5760	11.2026	11.5760	11.5760	11.2026	11.5760	11.2026	11.5760	(231)
Lighting	19.0422	15.2763	13.7546	10.0772	7.7840	6.3596	7.1008	9.2299	11.9887	15.7298	17.7668	19.5714	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.8374	-25.0495	-40.6440	-51.2425	-60.2341	-57.9825	-57.0592	-51.4970	-42.0573	-30.6737	-18.2140	-13.3632	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.1177	-7.4452	-16.6195	-27.6808	-38.7105	-39.7745	-39.2119	-31.7414	-21.6778	-11.4252	-4.4487	-2.3730	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year
Space heating fuel - main system 1 195.5822 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 100.0000
Water heating fuel used 2475.6013 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)
mechanical ventilation fans (SFP = 0.7000) 136.2984 (230a)
Total electricity for the above, kWh/year 136.2984 (231)
Electricity for lighting (calculated in Appendix L) 153.6812 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation -708.0805 (233)
Wind generation 0.0000 (234)
Hydro-electric generation (Appendix N) 0.0000 (235a)
Electricity generated - Micro CHP (Appendix N) 0.0000 (235)

Appendix Q - special features

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2253.0826	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	195.5822	16.4900	32.2515	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	16.4900	408.2267	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	136.2984	16.4900	22.4756	(249)
Energy for lighting	153.6812	16.4900	25.3420	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-463.8543	16.4900	-76.4896	
PV Unit electricity exported	-244.2261	5.5900	-13.6522	
Total			-90.1418	(252)
Total energy cost			398.1540	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2855	(257)
SAP value	79.1617	
SAP rating (Section 12)	79	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	195.5822	0.1606	31.4176	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2475.6013	0.1413	349.7834	(264)
Space and water heating			381.2010	(265)
Pumps, fans and electric keep-hot	136.2984	0.1387	18.9063	(267)
Energy for lighting	153.6812	0.1443	22.1809	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-463.8543	0.1323	-61.3768	
PV Unit electricity exported	-244.2261	0.1233	-30.1190	
Total			-91.4957	(269)
Total CO2, kg/year			330.7925	(272)
CO2 emissions per m2			4.9700	(273)
EI value			96.0246	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		66.5000 (1b)	x	2.4000 (2b)	=	159.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.5000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.6000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	43.9000	19.6900	24.2100	0.1400	3.3894	14.0000	338.9400	(29a)
Total net area of external elements Aum(A, m2)			43.9000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.7211			(33)
Party Wall 1			55.9300	0.0000	0.0000	20.0000	1118.6000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.5000			80.0000	5320.0000	(32d)
Party Ceiling 1			66.5000			80.0000	5320.0000	(32b)
Internal Wall 1			140.2900			9.0000	1262.6100	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13437.1500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 202.0624 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.1600	0.0700	1.1312
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	22.1400	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.0392 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 30.7603 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.1032	16.1032	15.7675	14.7602	14.5923	13.9208	13.5851	13.5851	14.2566	15.0960	15.4317	15.2638	(38)
Heat transfer coeff	46.8636	46.8636	46.5278	45.5206	45.3527	44.6812	44.3454	44.3454	45.0169	45.8563	46.1921	46.0242	(39)
Average = Sum(39)m / 12 =												45.6325	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7047	0.7047	0.6997	0.6845	0.6820	0.6719	0.6668	0.6668	0.6769	0.6896	0.6946	0.6921	(40)
HLP (average)												0.6862	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1583 (42)
Hot water usage for mixer showers

83.0588	81.8106	79.9917	76.5116	73.9433	71.0793	69.4513	71.2564	73.2352	76.3103	79.8652	82.7406	(42a)

Hot water usage for baths

26.1000	25.7123	25.1665	24.1600	23.4064	22.5708	22.1194	22.6614	23.2516	24.1458	25.1729	26.0117	(42b)

Hot water usage for other uses

36.7327	35.3969	34.0612	32.7255	31.3897	30.0540	30.0540	31.3897	32.7255	34.0612	35.3969	36.7327	(42c)

Average daily hot water use (litres/day) 134.1695 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.8914	142.9198	139.2194	133.3971	128.7395	123.7040	121.6247	125.3076	129.2122	134.5173	140.4351	145.4849	(44)
Energy conte	231.0563	203.5159	213.9750	182.6139	173.3081	152.1085	147.0945	155.1570	159.3316	182.5387	200.0755	227.7943	(45)
Energy content (annual)										Total = Sum(45)m =		2228.5693	
Distribution loss (46)m = 0.15 x (45)m	34.6584	30.5274	32.0962	27.3921	25.9962	22.8163	22.0642	23.2735	23.8997	27.3808	30.0113	34.1691	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)

Total per year (kWh/year) = Sum(64)m = 2475.6013 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

93.6109	82.8294	87.9313	76.9623	74.4096	66.8193	65.6936	68.3743	69.2210	77.4788	82.7683	92.5262	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.7552	19.3227	15.7143	11.8967	8.8930	7.5078	8.1125	10.5449	14.1533	17.9709	20.9747	22.3598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	282.0814	285.0085	277.6323	261.9291	242.1067	223.4764	211.0302	208.1031	215.4793	231.1825	251.0049	269.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	(71)
Water heating gains (Table 5)													
	125.8211	123.2580	118.1873	106.8921	100.0129	92.8046	88.2978	91.9010	96.1402	104.1381	114.9560	124.3632	(72)
Total internal gains													
	522.9304	520.8621	504.8066	473.9908	444.2853	417.0615	400.7133	403.8217	419.0457	446.5643	480.2084	509.6310	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	11.8100	33.4622	0.6300	0.8270	0.7700	142.6869	(77)
Southwest	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(79)

Solar gains	237.8920	432.4913	618.4356	806.0340	893.6844	862.2965	841.6682	750.0695	663.6383	475.1307	292.8315	208.1992	(83)
Total gains	760.8224	953.3534	1123.2423	1280.0248	1337.9696	1279.3581	1242.3814	1153.8912	1082.6839	921.6950	773.0399	717.8302	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000	(85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	79.6469	79.6469	80.2217	81.9968	82.3004	83.5373	84.1698	84.1698	82.9142	81.3965	80.8048	81.0996	
alpha	6.3098	6.3098	6.3481	6.4665	6.4867	6.5692	6.6113	6.6113	6.5276	6.4264	6.3870	6.4066	
util living area													
	0.8845	0.7655	0.6241	0.4641	0.3489	0.2724	0.2177	0.2383	0.3407	0.5560	0.7919	0.9054	(86)
MIT	20.7303	20.8890	20.9674	20.9952	20.9993	20.9999	21.0000	21.0000	20.9995	20.9880	20.8884	20.6918	(87)
Th 2	20.3367	20.3367	20.3411	20.3545	20.3568	20.3657	20.3702	20.3702	20.3612	20.3501	20.3456	20.3478	(88)
util rest of house													
	0.8685	0.7432	0.6000	0.4416	0.3272	0.2502	0.1952	0.2141	0.3143	0.5256	0.7669	0.8915	(89)
MIT 2	20.0414	20.2207	20.3088	20.3501	20.3562	20.3657	20.3702	20.3702	20.3609	20.3395	20.2318	20.0064	(90)
Living area fraction									fLA = Living area / (4) =			0.3370	(91)
MIT	20.2736	20.4459	20.5307	20.5675	20.5729	20.5794	20.5824	20.5824	20.5761	20.5580	20.4531	20.2374	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2736	20.4459	20.5307	20.5675	20.5729	20.5794	20.5824	20.5824	20.5761	20.5580	20.4531	20.2374	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8668	0.7469	0.6070	0.4491	0.3345	0.2577	0.2028	0.2222	0.3232	0.5354	0.7711	0.8889	(94)
Useful gains	659.5127	712.1003	681.7671	574.8005	447.5175	329.6864	251.9844	256.4141	349.9080	493.4880	596.1068	638.1040	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	767.3236	756.6545	694.6943	576.6309	447.7632	329.7195	251.9897	256.4237	350.0571	497.9093	639.9012	761.1189	(97)
Space heating kWh													
	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(98a)
Space heating requirement - total per year (kWh/year)												247.6148	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												247.6148	
Space heating per m2										(98c) / (4) =		3.7235	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(219)
Space cooling fuel requirement													

(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5760	10.4558	11.5760	11.2026	11.5760	11.2026	11.5760	11.5760	11.2026	11.5760	11.2026	11.5760	(231)
Lighting	19.0422	15.2763	13.7546	10.0772	7.7840	6.3596	7.1008	9.2299	11.9887	15.7298	17.7668	19.5714	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.3659	-24.1373	-40.6748	-53.4156	-62.3565	-58.8247	-58.3796	-51.5126	-41.7801	-29.4038	-16.9601	-12.3644	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.6228	-6.9252	-16.5691	-29.8250	-41.2999	-40.8780	-40.9539	-31.7592	-21.4223	-10.5980	-3.9084	-2.0636	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	247.6148	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2475.6013	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.2984	(230a)
Total electricity for the above, kWh/year	136.2984	(231)
Electricity for lighting (calculated in Appendix L)	153.6812	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-713.0011	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2300.1947	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	247.6148	25.1600	62.2999	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	25.1600	622.8613	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	136.2984	25.1600	34.2927	(249)
Energy for lighting	153.6812	25.1600	38.6662	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.1755	25.1600	-116.7865	
PV Unit electricity exported	-248.8256	5.8100	-14.4568	
Total			-131.2433	(252)
Total energy cost			626.8767	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	247.6148	0.1602	39.6760	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2475.6013	0.1413	349.7834	(264)
Space and water heating			389.4594	(265)
Pumps, fans and electric keep-hot	136.2984	0.1387	18.9063	(267)
Energy for lighting	153.6812	0.1443	22.1809	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.1755	0.1320	-61.2773	
PV Unit electricity exported	-248.8256	0.1228	-30.5608	
Total			-91.8382	(269)
Total CO2, kg/year			338.7085	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	247.6148	1.5930	394.4398	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	1.5225	3769.0221	(278)
Space and water heating			4163.4620	(279)
Pumps, fans and electric keep-hot	136.2984	1.5128	206.1922	(281)
Energy for lighting	153.6812	1.5338	235.7213	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.1755	1.4878	-690.5810	
PV Unit electricity exported	-248.8256	0.4508	-112.1583	
Total			-802.7393	(283)
Total Primary energy kWh/year			3802.6362	(286)

SAP 10 EPC IMPROVEMENTS

Unit 74 L04_Copy

Current energy efficiency rating: C 79
Current environmental impact rating: A 96

N Solar water heating — Not applicable
U Solar photovoltaic panels — Not applicable
V2 Wind turbine — Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 79
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£758	£758	£0
Space heating	£97	£97	£0
Water heating	£623	£623	£0
Lighting	£39	£39	£0
Generated (PV)	-£131	-£131	£0
Total cost of fuels	£627	£627	£0
Total cost of uses	£628	£628	£0
Delivered energy	35 kWh/m²	35 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	57 kWh/m²	57 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.5000 (1b)	x	2.4000 (2b)	=	159.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.6000	(5)

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2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation — 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) — 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = — 72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	43.9000	19.6900	24.2100	0.1400	3.3894	14.0000	338.9400	(29a)
Total net area of external elements Aum(A, m2)			43.9000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.7211			(33)
Party Wall 1			55.9300	0.0000	0.0000	20.0000	1118.6000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.5000			80.0000	5320.0000	(32d)
Party Ceiling 1			66.5000			80.0000	5320.0000	(32b)
Internal Wall 1			140.2900			9.0000	1262.6100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13437.1500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.0624 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.1600	0.0700	1.1312
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	22.1400	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.0392 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	30.7603 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.9354	15.7675	15.5996	14.7602	14.5923	13.7529	13.7529	13.5851	14.0887	14.5923	14.9281	15.2638	(38)
Heat transfer coeff	46.6957	46.5278	46.3600	45.5206	45.3527	44.5133	44.5133	44.3454	44.8490	45.3527	45.6884	46.0242	(39)
Average = Sum(39)m / 12 =												45.4786	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7022	0.6997	0.6971	0.6845	0.6820	0.6694	0.6694	0.6668	0.6744	0.6820	0.6870	0.6921	(40)
HLP (average)												0.6839	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.1583 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
83.0588	81.8106	79.9917	76.5116	73.9433	71.0793	69.4513	71.2564	73.2352	76.3103	79.8652	82.7406	(42a)

Hot water usage for baths

26.1000	25.7123	25.1665	24.1600	23.4064	22.5708	22.1194	22.6614	23.2516	24.1458	25.1729	26.0117	(42b)

Hot water usage for other uses

36.7327	35.3969	34.0612	32.7255	31.3897	30.0540	30.0540	31.3897	32.7255	34.0612	35.3969	36.7327	(42c)

Average daily hot water use (litres/day)		134.1695 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.8914	142.9198	139.2194	133.3971	128.7395	123.7040	121.6247	125.3076	129.2122	134.5173	140.4351	145.4849	(44)
Energy conte	231.0563	203.5159	213.9750	182.6139	173.3081	152.1085	147.0945	155.1570	159.3316	182.5387	200.0755	227.7943	(45)
Energy content (annual)										Total = Sum(45)m =		2228.5693	

Distribution loss (46)m = 0.15 x (45)m

34.6584	30.5274	32.0962	27.3921	25.9962	22.8163	22.0642	23.2735	23.8997	27.3808	30.0113	34.1691	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
									Total per year (kWh/year) = Sum(64)m =		2475.6013	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

93.6109	82.8294	87.9313	76.9623	74.4096	66.8193	65.6936	68.3743	69.2210	77.4788	82.7683	92.5262	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7552	19.3227	15.7143	11.8967	8.8930	7.5078	8.1125	10.5449	14.1533	17.9709	20.9747	22.3598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	282.0814	285.0085	277.6323	261.9291	242.1067	223.4764	211.0302	208.1031	215.4793	231.1825	251.0049	269.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	(71)
Water heating gains (Table 5)	125.8211	123.2580	118.1873	106.8921	100.0129	92.8046	88.2978	91.9010	96.1402	104.1381	114.9560	124.3632	(72)
Total internal gains	522.9304	520.8621	504.8066	473.9908	444.2853	417.0615	400.7133	403.8217	419.0457	446.5643	480.2084	509.6310	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	11.8100	36.7938	0.6300	0.8270	0.7700	156.8932	(77)
Southwest	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	261.5773	445.5629	609.6386	755.3718	846.0793	839.9609	809.8120	742.1401	660.1097	492.4419	313.3093	223.8557	(83)
Total gains	784.5077	966.4250	1114.4452	1229.3625	1290.3646	1257.0225	1210.5252	1145.9618	1079.1553	939.0062	793.5177	733.4867	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	79.9333	80.2217	80.5122	81.9968	82.3004	83.8523	83.8523	84.1698	83.2246	82.3004	81.6955	81.0996	
alpha	6.3289	6.3481	6.3675	6.4665	6.4867	6.5902	6.5902	6.6113	6.5483	6.4867	6.4464	6.4066	
util living area	0.8610	0.7342	0.5934	0.4467	0.3267	0.2266	0.1618	0.1780	0.2867	0.4994	0.7534	0.8867	(86)
MIT	20.7806	20.9169	20.9770	20.9964	20.9996	21.0000	21.0000	21.0000	20.9999	20.9943	20.9214	20.7412	(87)
Th 2	20.3389	20.3411	20.3434	20.3545	20.3568	20.3680	20.3680	20.3702	20.3635	20.3568	20.3523	20.3478	(88)
util rest of house	0.8427	0.7107	0.5685	0.4232	0.3042	0.2042	0.1386	0.1536	0.2603	0.4693	0.7265	0.8706	(89)
MIT 2	20.1020	20.2557	20.3211	20.3513	20.3564	20.3679	20.3680	20.3702	20.3634	20.3519	20.2739	20.0650	(90)
Living area fraction										fLA = Living area / (4) =		0.3370	(91)
MIT	20.3307	20.4785	20.5421	20.5687	20.5732	20.5809	20.5810	20.5824	20.5779	20.5684	20.4921	20.2928	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3307	20.4785	20.5421	20.5687	20.5732	20.5809	20.5810	20.5824	20.5779	20.5684	20.4921	20.2928	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8425	0.7157	0.5761	0.4310	0.3118	0.2118	0.1464	0.1618	0.2692	0.4793	0.7325	0.8692	(94)
Useful gains	660.9362	691.6463	641.9935	529.8378	402.2774	266.2236	177.2049	185.4711	290.4875	450.0389	581.2287	637.5157	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	748.5635	724.8350	650.9921	531.1672	402.4220	266.2311	177.2054	185.4720	290.5269	452.0934	611.8637	740.6597	(97)
Space heating kWh	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(98a)
Space heating requirement - total per year (kWh/year)												195.5822	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												195.5822	
Space heating per m2										(98c) / (4) =		2.9411	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5760	10.4558	11.5760	11.2026	11.5760	11.2026	11.5760	11.5760	11.2026	11.5760	11.2026	11.5760	(231)
Lighting	19.0422	15.2763	13.7546	10.0772	7.7840	6.3596	7.1008	9.2299	11.9887	15.7298	17.7668	19.5714	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.8374	-25.0495	-40.6440	-51.2425	-60.2341	-57.9825	-57.0592	-51.4970	-42.0573	-30.6737	-18.2140	-13.3632	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.1177	-7.4452	-16.6195	-27.6808	-38.7105	-39.7745	-39.2119	-31.7414	-21.6778	-11.4252	-4.4487	-2.3730	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	195.5822	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2475.6013	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.2984	(230a)
Total electricity for the above, kWh/year	136.2984	(231)
Electricity for lighting (calculated in Appendix L)	153.6812	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-708.0805	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2253.0826	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	195.5822	16.4900	32.2515	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	16.4900	408.2267	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	136.2984	16.4900	22.4756	(249)
Energy for lighting	153.6812	16.4900	25.3420	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-463.8543	16.4900	-76.4896	
PV Unit electricity exported	-244.2261	5.5900	-13.6522	
Total			-90.1418	(252)
Total energy cost			398.1540	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2855	(257)
SAP value		79.1617	
SAP rating (Section 12)		79	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	195.5822	0.1606	31.4176	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2475.6013	0.1413	349.7834	(264)
Space and water heating			381.2010	(265)
Pumps, fans and electric keep-hot	136.2984	0.1387	18.9063	(267)
Energy for lighting	153.6812	0.1443	22.1809	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-463.8543	0.1323	-61.3768	
PV Unit electricity exported	-244.2261	0.1233	-30.1190	
Total			-91.4957	(269)
Total CO2, kg/year			330.7925	(272)
CO2 emissions per m2			4.9700	(273)
EI value			96.0246	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.5000	(1b)	x 2.4000	(2b) =	159.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		159.6000	(5)

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2. Ventilation rate

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m3 per hour

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery		
If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	43.9000	19.6900	24.2100	0.1400	3.3894	14.0000	338.9400	(29a)
Total net area of external elements Aum(A, m2)			43.9000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.7211			(33)
Party Wall 1			55.9300	0.0000	0.0000	20.0000	1118.6000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.5000			80.0000	5320.0000	(32d)
Party Ceiling 1			66.5000			80.0000	5320.0000	(32b)
Internal Wall 1			140.2900			9.0000	1262.6100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13437.1500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.0624 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.1600	0.0700	1.1312
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	22.1400	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.0392 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	30.7603 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.1032	16.1032	15.7675	14.7602	14.5923	13.9208	13.5851	13.5851	14.2566	15.0960	15.4317	15.2638	(38)
Heat transfer coeff	46.8636	46.8636	46.5278	45.5206	45.3527	44.6812	44.3454	44.3454	45.0169	45.8563	46.1921	46.0242	(39)
Average = Sum(39)m / 12 =												45.6325	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7047	0.7047	0.6997	0.6845	0.6820	0.6719	0.6668	0.6668	0.6769	0.6896	0.6946	0.6921	(40)
HLP (average)												0.6862	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.1583 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
83.0588	81.8106	79.9917	76.5116	73.9433	71.0793	69.4513	71.2564	73.2352	76.3103	79.8652	82.7406	(42a)

Hot water usage for baths

26.1000	25.7123	25.1665	24.1600	23.4064	22.5708	22.1194	22.6614	23.2516	24.1458	25.1729	26.0117	(42b)

Hot water usage for other uses

36.7327	35.3969	34.0612	32.7255	31.3897	30.0540	30.0540	31.3897	32.7255	34.0612	35.3969	36.7327	(42c)

Average daily hot water use (litres/day)		134.1695 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.8914	142.9198	139.2194	133.3971	128.7395	123.7040	121.6247	125.3076	129.2122	134.5173	140.4351	145.4849	(44)
Energy conte	231.0563	203.5159	213.9750	182.6139	173.3081	152.1085	147.0945	155.1570	159.3316	182.5387	200.0755	227.7943	(45)
Energy content (annual)										Total = Sum(45)m =		2228.5693	
Distribution loss (46)m = 0.15 x (45)m	34.6584	30.5274	32.0962	27.3921	25.9962	22.8163	22.0642	23.2735	23.8997	27.3808	30.0113	34.1691	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
										Total per year (kWh/year) = Sum(64)m =		2475.6013	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	93.6109	82.8294	87.9313	76.9623	74.4096	66.8193	65.6936	68.3743	69.2210	77.4788	82.7683	92.5262	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.7552	19.3227	15.7143	11.8967	8.8930	7.5078	8.1125	10.5449	14.1533	17.9709	20.9747	22.3598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	282.0814	285.0085	277.6323	261.9291	242.1067	223.4764	211.0302	208.1031	215.4793	231.1825	251.0049	269.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	(71)
Water heating gains (Table 5)													
	125.8211	123.2580	118.1873	106.8921	100.0129	92.8046	88.2978	91.9010	96.1402	104.1381	114.9560	124.3632	(72)
Total internal gains													
	522.9304	520.8621	504.8066	473.9908	444.2853	417.0615	400.7133	403.8217	419.0457	446.5643	480.2084	509.6310	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	11.8100	33.4622	0.6300	0.8270	0.7700	142.6869	(77)
Southwest	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(79)

Solar gains	237.8920	432.4913	618.4356	806.0340	893.6844	862.2965	841.6682	750.0695	663.6383	475.1307	292.8315	208.1992	(83)
Total gains	760.8224	953.3534	1123.2423	1280.0248	1337.9696	1279.3581	1242.3814	1153.8912	1082.6839	921.6950	773.0399	717.8302	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	79.6469	79.6469	80.2217	81.9968	82.3004	83.5373	84.1698	84.1698	82.9142	81.3965	80.8048	81.0996	
alpha	6.3098	6.3098	6.3481	6.4665	6.4867	6.5692	6.6113	6.6113	6.5276	6.4264	6.3870	6.4066	
util living area													
	0.8845	0.7655	0.6241	0.4641	0.3489	0.2724	0.2177	0.2383	0.3407	0.5560	0.7919	0.9054	(86)
MIT	20.7303	20.8890	20.9674	20.9952	20.9993	20.9999	21.0000	21.0000	20.9995	20.9880	20.8884	20.6918	(87)
Th 2	20.3367	20.3367	20.3411	20.3545	20.3568	20.3657	20.3702	20.3702	20.3612	20.3501	20.3456	20.3478	(88)
util rest of house													
	0.8685	0.7432	0.6000	0.4416	0.3272	0.2502	0.1952	0.2141	0.3143	0.5256	0.7669	0.8915	(89)
MIT 2	20.0414	20.2207	20.3088	20.3501	20.3562	20.3657	20.3702	20.3702	20.3609	20.3395	20.2318	20.0064	(90)
Living area fraction										fLA = Living area / (4) =		0.3370	(91)
MIT	20.2736	20.4459	20.5307	20.5675	20.5729	20.5794	20.5824	20.5824	20.5761	20.5580	20.4531	20.2374	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2736	20.4459	20.5307	20.5675	20.5729	20.5794	20.5824	20.5824	20.5761	20.5580	20.4531	20.2374	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8668	0.7469	0.6070	0.4491	0.3345	0.2577	0.2028	0.2222	0.3232	0.5354	0.7711	0.8889	(94)
Useful gains	659.5127	712.1003	681.7671	574.8005	447.5175	329.6864	251.9844	256.4141	349.9080	493.4880	596.1068	638.1040	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	767.3236	756.6545	694.6943	576.6309	447.7632	329.7195	251.9897	256.4237	350.0571	497.9093	639.9012	761.1189	(97)
Space heating kWh													
	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(98a)
Space heating requirement - total per year (kWh/year)												247.6148	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												247.6148	
Space heating per m2											(98c) / (4) =	3.7235	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement												

	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5760	10.4558	11.5760	11.2026	11.5760	11.2026	11.5760	11.5760	11.2026	11.5760	11.2026	11.5760	(231)
Lighting	19.0422	15.2763	13.7546	10.0772	7.7840	6.3596	7.1008	9.2299	11.9887	15.7298	17.7668	19.5714	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.3659	-24.1373	-40.6748	-53.4156	-62.3565	-58.8247	-58.3796	-51.5126	-41.7801	-29.4038	-16.9601	-12.3644	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.6228	-6.9252	-16.5691	-29.8250	-41.2999	-40.8780	-40.9539	-31.7592	-21.4223	-10.5980	-3.9084	-2.0636	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	247.6148	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2475.6013	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.2984	(230a)
Total electricity for the above, kWh/year	136.2984	(231)
Electricity for lighting (calculated in Appendix L)	153.6812	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-713.0011	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2300.1947	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	247.6148	25.1600	62.2999	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	25.1600	622.8613	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	136.2984	25.1600	34.2927	(249)
Energy for lighting	153.6812	25.1600	38.6662	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.1755	25.1600	-116.7865	
PV Unit electricity exported	-248.8256	5.8100	-14.4568	
Total			-131.2433	(252)
Total energy cost			626.8767	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	247.6148	0.1602	39.6760	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2475.6013	0.1413	349.7834	(264)
Space and water heating			389.4594	(265)
Pumps, fans and electric keep-hot	136.2984	0.1387	18.9063	(267)
Energy for lighting	153.6812	0.1443	22.1809	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.1755	0.1320	-61.2773	
PV Unit electricity exported	-248.8256	0.1228	-30.5608	
Total			-91.8382	(269)
Total CO2, kg/year			338.7085	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	

Space heating - main system 1	247.6148	1.5930	394.4398	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	1.5225	3769.0221	(278)
Space and water heating			4163.4620	(279)
Pumps, fans and electric keep-hot	136.2984	1.5128	206.1922	(281)
Energy for lighting	153.6812	1.5338	235.7213	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.1755	1.4878	-690.5810	
PV Unit electricity exported	-248.8256	0.4508	-112.1583	
Total			-802.7393	(283)
Total Primary energy kWh/year			3802.6362	(286)

Predicted Energy Assessment

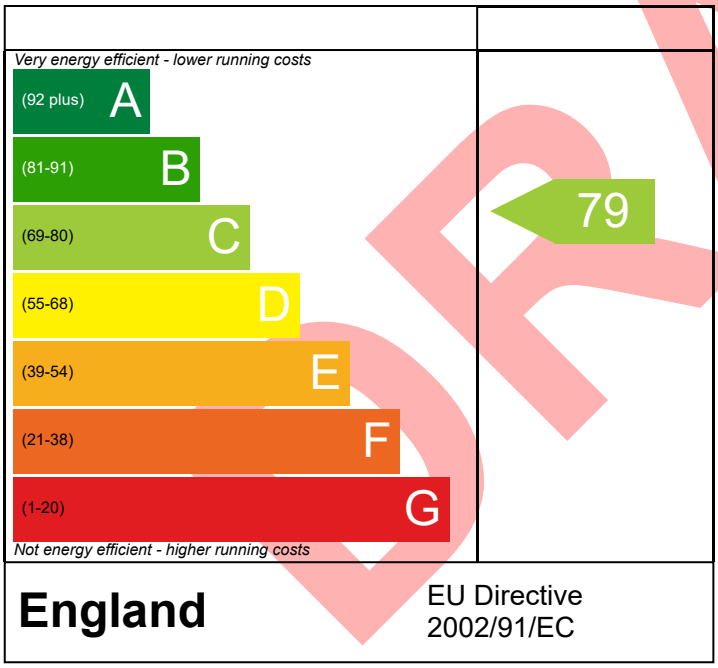
elmhurst energy

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	66.5 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

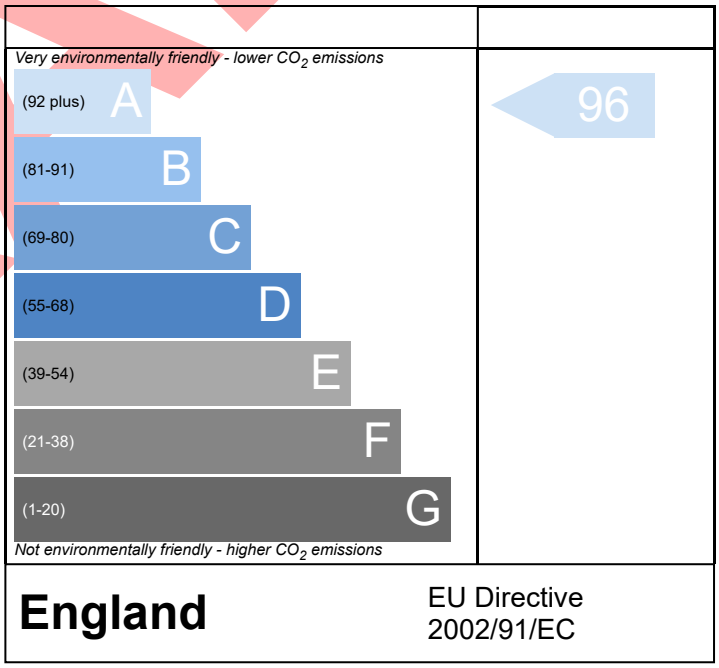
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:45

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	49 m^2
Site Reference	Unit 75 L04_Copy	Plot Reference	Unit 75 L04_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.77 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	5.62 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*64.09 kWh_{PE}/m^2*	
Dwelling primary energy	63.15 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*14.4 kWh/m^2*	
Dwelling fabric energy efficiency	13.7 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	7.88	0.14 **(!)**
Party wall: Party Wall (1)	24.84	0 **(!)**
Party wall: Party Wall (2)	39.01	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	6.29	North East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.63 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 75 L04_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 75 L04_Copy	**Prop Type Ref**	Unit 75 L04
Property			

SAP Rating	79 C	**DER**	5.62	**TER**	11.77
Environmental	96 A	**% DER < TER**			52.25
CO_2 Emissions (t/year)	0.27	**DFEE**	13.68	**TFEE**	14.36
Compliance Check	See BREL	**% DFEE < TFEE**			4.74
% DPER < TPER	1.47	**DPER**	63.15	**TPER**	64.09

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.8100	(1b)	x 2.4000	(2b) =	117.1440	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.8100					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		117.1440	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.2900	1.2357	7.7728			(27)
External Wall 1	14.1700	6.2900	7.8800	0.1400	1.1032	14.0000	110.3200	(29a)
Total net area of external elements Aum(A, m2)			14.1700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		8.8760			(33)
Party Wall 1			24.8400	0.0000	0.0000	20.0000	496.8000	(32)
Wall to corridor			39.0100	0.0000	0.0000	20.0000	780.2000	(32)
Party Floor 1			48.8100			80.0000	3904.8000	(32d)
Party Ceiling 1			48.8100			80.0000	3904.8000	(32b)
Internal Wall 1			72.6800			9.0000	654.1200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 9851.0400	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	201.8242	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.7100	0.0500	0.1355

E4 Jamb	9.2800	0.0500	0.4640	
E7 Party floor between dwellings (in blocks of flats)	5.2500	0.0700	0.3675	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	20.8400	0.0000	0.0000	
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.2910 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 10.1670 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.1418	11.0295	10.9171	10.3554	10.2430	9.6813	9.6813	9.5689	9.9060	10.2430	10.4677	10.6924	(38)
Heat transfer coeff	21.3088	21.1965	21.0841	20.5224	20.4100	19.8483	19.8483	19.7360	20.0730	20.4100	20.6347	20.8594	(39)
Average = Sum(39)m / 12 =												20.4943	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4366	0.4343	0.4320	0.4205	0.4182	0.4066	0.4066	0.4043	0.4112	0.4182	0.4228	0.4274	(40)
HLP (average)												0.4199	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6551 (42)
Hot water usage for mixer showers

71.4595	70.3856	68.8207	65.8266	63.6170	61.1529	59.7523	61.3053	63.0077	65.6534	68.7119	71.1857	(42a)

Hot water usage for baths

22.4723	22.1385	21.6685	20.8020	20.1531	19.4336	19.0450	19.5117	20.0198	20.7897	21.6741	22.3963	(42b)

Hot water usage for other uses

31.5802	30.4318	29.2834	28.1350	26.9867	25.8383	25.8383	26.9867	28.1350	29.2834	30.4318	31.5802	(42c)

Average daily hot water use (litres/day) 115.4278 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	125.5119	122.9558	119.7726	114.7636	110.7568	106.4248	104.6356	107.8037	111.1626	115.7265	120.8177	125.1621	(44)
Energy conte	198.7801	175.0875	184.0861	157.1056	149.0999	130.8617	126.5476	133.4834	137.0746	157.0398	172.1270	195.9736	(45)
Energy content (annual)											Total = Sum(45)m =	1917.2669	
Distribution loss (46)m = 0.15 x (45)m	29.8170	26.2631	27.6129	23.5658	22.3650	19.6293	18.9821	20.0225	20.5612	23.5560	25.8191	29.3960	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
										Total per year (kWh/year) = Sum(64)m =		2164.2989	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	82.8790	73.3769	77.9933	68.4808	66.3603	59.7547	58.8617	61.1679	61.8205	69.0004	73.4754	81.9459	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.4855	15.5304	12.6302	9.5619	7.1476	6.0343	6.5203	8.4753	11.3756	14.4439	16.8582	17.9715	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.1398	217.3723	211.7465	199.7699	184.6516	170.4425	160.9500	158.7175	164.3433	176.3199	191.4382	205.6473	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	(71)
Water heating gains (Table 5)	111.3965	109.1918	104.8296	95.1122	89.1940	82.9927	79.1152	82.2149	85.8618	92.7424	102.0492	110.1423	(72)
Total internal gains	423.7103	421.7830	408.8948	384.1325	360.6817	339.1579	326.2739	329.0962	341.2691	363.1946	390.0340	413.4494	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.2900	11.2829	0.6300	0.8270	0.7700	25.6243	(75)

Solar gains	25.6243	52.1590	93.9740	154.3323	207.4529	221.1667	206.8969	164.9406	114.5088	63.7425	32.2420	20.9261	(83)
Total gains	449.3346	473.9420	502.8688	538.4647	568.1345	560.3246	533.1709	494.0368	455.7778	426.9371	422.2760	434.3755	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	128.4162	129.0969	129.7848	133.3373	134.0712	137.8657	137.8657	138.6505	136.3224	134.0712	132.6113	131.1828	
alpha	9.5611	9.6065	9.6523	9.8892	9.9381	10.1910	10.1910	10.2434	10.0882	9.9381	9.8408	9.7455	
util living area													
	0.7726	0.7112	0.6060	0.4610	0.3341	0.2267	0.1638	0.1838	0.3039	0.4969	0.6743	0.7854	(86)
MIT	20.9734	20.9871	20.9970	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9997	20.9936	20.9715	(87)
Th 2	20.5793	20.5815	20.5836	20.5943	20.5964	20.6071	20.6071	20.6093	20.6028	20.5964	20.5921	20.5879	(88)
util rest of house													
	0.7562	0.6942	0.5890	0.4456	0.3196	0.2128	0.1492	0.1682	0.2864	0.4777	0.6555	0.7694	(89)
MIT 2	20.5513	20.5682	20.5806	20.5941	20.5964	20.6071	20.6071	20.6093	20.6028	20.5961	20.5859	20.5578	(90)
Living area fraction										fLA = Living area / (4) =		0.5530	(91)
MIT	20.7847	20.7999	20.8108	20.8184	20.8196	20.8244	20.8244	20.8253	20.8225	20.8193	20.8113	20.7866	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7847	20.7999	20.8108	20.8184	20.8196	20.8244	20.8244	20.8253	20.8225	20.8193	20.8113	20.7866	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7643	0.7031	0.5983	0.4541	0.3276	0.2205	0.1573	0.1768	0.2961	0.4883	0.6657	0.7772	(94)
Useful gains	343.4042	333.2384	300.8562	244.5404	186.1291	123.5433	83.8467	87.3382	134.9394	208.4897	281.0919	337.5907	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	351.2699	337.0213	301.7319	244.5949	186.1310	123.5433	83.8467	87.3382	134.9399	208.5761	282.9300	345.9870	(97)
Space heating kWh	5.8521	2.5421	0.6515	0.0392	0.0014	0.0000	0.0000	0.0000	0.0000	0.0643	1.3235	6.2469	(98a)
Space heating requirement - total per year (kWh/year)												16.7210	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	5.8521	2.5421	0.6515	0.0392	0.0014	0.0000	0.0000	0.0000	0.0000	0.0643	1.3235	6.2469	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												16.7210	
Space heating per m2											(98c) / (4) =	0.3426	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	5.8521	2.5421	0.6515	0.0392	0.0014	0.0000	0.0000	0.0000	0.0000	0.0643	1.3235	6.2469	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	5.8521	2.5421	0.6515	0.0392	0.0014	0.0000	0.0000	0.0000	0.0000	0.0643	1.3235	6.2469	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.4966	7.6744	8.4966	8.2225	8.4966	8.2225	8.4966	8.4966	8.2225	8.4966	8.2225	8.4966	(231)
Lighting	15.3049	12.2782	11.0551	8.0995	6.2563	5.1114	5.7072	7.4184	9.6358	12.6427	14.2798	15.7303	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.6124	-18.5300	-30.3052	-38.4596	-45.4028	-43.7828	-43.0940	-38.8073	-31.5720	-22.8790	-13.4504	-9.7805	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.2732	-5.2742	-11.6436	-19.3564	-27.0799	-27.8299	-27.4302	-22.1697	-15.1176	-7.9609	-3.1514	-1.7472	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												16.7210	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2164.2989	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)													
mechanical ventilation fans (SFP = 0.7000)												100.0410	(230a)
Total electricity for the above, kWh/year												100.0410	(231)
Electricity for lighting (calculated in Appendix L)												123.5196	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-518.7101	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)

Appendix Q - special features

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1885.8704	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	16.7210	16.4900	2.7573	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	16.4900	356.8929	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	100.0410	16.4900	16.4968	(249)
Energy for lighting	123.5196	16.4900	20.3684	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.6760	16.4900	-57.3318	
PV Unit electricity exported	-171.0341	5.5900	-9.5608	
Total			-66.8926	(252)
Total energy cost			329.6227	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2649	(257)
SAP value	79.4953	
SAP rating (Section 12)	79	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	16.7210	0.1611	2.6929	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2164.2989	0.1413	305.7097	(264)
Space and water heating			308.4027	(265)
Pumps, fans and electric keep-hot	100.0410	0.1387	13.8769	(267)
Energy for lighting	123.5196	0.1443	17.8277	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.6760	0.1322	-45.9596	
PV Unit electricity exported	-171.0341	0.1234	-21.1138	
Total			-67.0733	(269)
Total CO2, kg/year			273.0339	(272)
CO2 emissions per m2			5.5900	(273)
EI value			96.0999	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.8100	(1b)	x 2.4000	(2b) =	117.1440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 48.8100						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		117.1440	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor (20) = 1 - [0.075 x (19)] =		0.7750	(20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.2900	1.2357	7.7728			(27)
External Wall 1	14.1700	6.2900	7.8800	0.1400	1.1032	14.0000	110.3200	(29a)
Total net area of external elements Aum(A, m2)			14.1700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	8.8760			(33)
Party Wall 1			24.8400	0.0000	0.0000	20.0000	496.8000	(32)
Wall to corridor			39.0100	0.0000	0.0000	20.0000	780.2000	(32)
Party Floor 1			48.8100			80.0000	3904.8000	(32d)
Party Ceiling 1			48.8100			80.0000	3904.8000	(32b)
Internal Wall 1			72.6800			9.0000	654.1200	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9851.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 201.8242 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.7100	0.0500	0.1355
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.2500	0.0700	0.3675
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	20.8400	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.2910 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 10.1670 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.2542	11.2542	11.0295	10.3554	10.2430	9.7936	9.5689	9.5689	10.0183	10.5801	10.8048	10.6924	(38)
Heat transfer coeff	21.4212	21.4212	21.1965	20.5224	20.4100	19.9607	19.7360	19.7360	20.1854	20.7471	20.9718	20.8594	(39)

Average = Sum(39)m / 12 = 20.5973

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4389	0.4389	0.4343	0.4205	0.4182	0.4089	0.4043	0.4043	0.4135	0.4251	0.4297	0.4274	(40)
HLP (average)												0.4220	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6551 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	71.4595	70.3856	68.8207	65.8266	63.6170	61.1529	59.7523	61.3053	63.0077	65.6534	68.7119	71.1857	(42a)
Hot water usage for baths	22.4723	22.1385	21.6685	20.8020	20.1531	19.4336	19.0450	19.5117	20.0198	20.7897	21.6741	22.3963	(42b)
Hot water usage for other uses	31.5802	30.4318	29.2834	28.1350	26.9867	25.8383	25.8383	26.9867	28.1350	29.2834	30.4318	31.5802	(42c)

Average daily hot water use (litres/day) 115.4278 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	125.5119	122.9558	119.7726	114.7636	110.7568	106.4248	104.6356	107.8037	111.1626	115.7265	120.8177	125.1621	(44)
Energy conte	198.7801	175.0875	184.0861	157.1056	149.0999	130.8617	126.5476	133.4834	137.0746	157.0398	172.1270	195.9736	(45)

Energy content (annual) Total = Sum(45)m = 1917.2669

Distribution loss (46)m = 0.15 x (45)m	29.8170	26.2631	27.6129	23.5658	22.3650	19.6293	18.9821	20.0225	20.5612	23.5560	25.8191	29.3960	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)

Total per year (kWh/year) = Sum(64)m = 2164.2989 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	82.8790	73.3769	77.9933	68.4808	66.3603	59.7547	58.8617	61.1679	61.8205	69.0004	73.4754	81.9459	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	17.4855	15.5304	12.6302	9.5619	7.1476	6.0343	6.5203	8.4753	11.3756	14.4439	16.8582	17.9715	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	215.1398	217.3723	211.7465	199.7699	184.6516	170.4425	160.9500	158.7175	164.3433	176.3199	191.4382	205.6473	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	(71)

Water heating gains (Table 5)

	111.3965	109.1918	104.8296	95.1122	89.1940	82.9927	79.1152	82.2149	85.8618	92.7424	102.0492	110.1423	(72)

Total internal gains

	423.7103	421.7830	408.8948	384.1325	360.6817	339.1579	326.2739	329.0962	341.2691	363.1946	390.0340	413.4494	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.2900	10.0309	0.6300	0.8270	0.7700	22.7809	(75)

Solar gains	22.7809	49.3199	92.7016	160.6228	214.7931	223.1785	211.1088	162.9125	112.0170	59.8425	29.4243	19.0490	(83)
Total gains	446.4911	471.1029	501.5964	544.7552	575.4748	562.3364	537.3828	492.0087	453.2861	423.0371	419.4582	432.4984	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	127.7427	127.7427	129.0969	133.3373	134.0712	137.0897	138.6505	138.6505	135.5637	131.8932	130.4800	131.1828	
alpha	9.5162	9.5162	9.6065	9.8892	9.9381	10.1393	10.2434	10.2434	10.0376	9.7929	9.6987	9.7455	
util living area	0.7948	0.7453	0.6471	0.4933	0.3653	0.2769	0.2240	0.2487	0.3651	0.5534	0.7114	0.8068	(86)
MIT	20.9651	20.9797	20.9943	20.9996	21.0000	21.0000	21.0000	21.0000	21.0000	20.9990	20.9890	20.9634	(87)
Th 2	20.5772	20.5772	20.5815	20.5943	20.5964	20.6050	20.6093	20.6093	20.6007	20.5900	20.5857	20.5879	(88)
util rest of house	0.7789	0.7287	0.6302	0.4781	0.3510	0.2628	0.2097	0.2330	0.3474	0.5335	0.6926	0.7915	(89)
MIT 2	20.5401	20.5560	20.5757	20.5939	20.5964	20.6050	20.6093	20.6093	20.6007	20.5891	20.5747	20.5487	(90)
Living area fraction										fLA = Living area / (4) =		0.5530	(91)
MIT	20.7751	20.7903	20.8072	20.8182	20.8196	20.8234	20.8253	20.8253	20.8215	20.8158	20.8038	20.7780	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7751	20.7903	20.8072	20.8182	20.8196	20.8234	20.8253	20.8253	20.8215	20.8158	20.8038	20.7780	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7864	0.7371	0.6393	0.4865	0.3589	0.2706	0.2176	0.2417	0.3572	0.5445	0.7025	0.7986	(94)
Useful gains	351.1385	347.2445	320.6771	265.0035	206.5358	152.1681	116.9421	118.9157	161.9131	230.3437	294.6735	345.4051	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	361.4839	353.2416	322.3390	265.1134	206.5408	152.1683	116.9421	118.9157	161.9165	230.6198	297.8783	356.2377	(97)
Space heating kWh	7.6970	4.0300	1.2365	0.0791	0.0037	0.0000	0.0000	0.0000	0.0000	0.2055	2.3075	8.0594	(98a)
Space heating requirement - total per year (kWh/year)												23.6187	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	7.6970	4.0300	1.2365	0.0791	0.0037	0.0000	0.0000	0.0000	0.0000	0.2055	2.3075	8.0594	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												23.6187	
Space heating per m2										(98c) / (4) =		0.4839	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	7.6970	4.0300	1.2365	0.0791	0.0037	0.0000	0.0000	0.0000	0.0000	0.2055	2.3075	8.0594	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	7.6970	4.0300	1.2365	0.0791	0.0037	0.0000	0.0000	0.0000	0.0000	0.2055	2.3075	8.0594	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating

Water heating requirement

	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(219)

Space cooling fuel requirement

(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.4966	7.6744	8.4966	8.2225	8.4966	8.2225	8.4966	8.4966	8.2225	8.4966	8.2225	8.4966	(231)
Lighting	15.3049	12.2782	11.0551	8.0995	6.2563	5.1114	5.7072	7.4184	9.6358	12.6427	14.2798	15.7303	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.5135	-17.8235	-30.3039	-40.1107	-47.0328	-44.4324	-44.1129	-38.8193	-31.3606	-21.9085	-12.4971	-9.0348	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.9317	-4.9317	-11.6305	-20.8679	-28.9016	-28.6057	-28.6546	-22.1822	-14.9388	-7.3951	-2.7904	-1.5346	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	23.6187	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2164.2989	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	100.0410	(230a)
Total electricity for the above, kWh/year	100.0410	(231)
Electricity for lighting (calculated in Appendix L)	123.5196	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-522.3147	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1889.1634	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	23.6187	25.1600	5.9425	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	25.1600	544.5376	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	100.0410	25.1600	25.1703	(249)
Energy for lighting	123.5196	25.1600	31.0775	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.9499	25.1600	-87.5442	
PV Unit electricity exported	-174.3648	5.8100	-10.1306	
Total			-97.6748	(252)
Total energy cost			509.0531	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	23.6187	0.1605	3.7905	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2164.2989	0.1413	305.7097	(264)
Space and water heating			309.5002	(265)
Pumps, fans and electric keep-hot	100.0410	0.1387	13.8769	(267)
Energy for lighting	123.5196	0.1443	17.8277	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.9499	0.1319	-45.8876	
PV Unit electricity exported	-174.3648	0.1230	-21.4411	
Total			-67.3287	(269)
Total CO2, kg/year			273.8761	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	23.6187	1.5940	37.6472	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	1.5223	3294.7406	(278)
Space and water heating			3332.3878	(279)
Pumps, fans and electric keep-hot	100.0410	1.5128	151.3420	(281)
Energy for lighting	123.5196	1.5338	189.4585	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.9499	1.4873	-517.4911	
PV Unit electricity exported	-174.3648	0.4513	-78.6883	
Total			-596.1795	(283)
Total Primary energy kWh/year			3077.0088	(286)

SAP 10 EPC IMPROVEMENTS

Unit 75 L04_Copy

Current energy efficiency rating: C 79
Current environmental impact rating: A 96

N Solar water heating — Not applicable
U Solar photovoltaic panels — Not applicable
V2 Wind turbine — Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 79
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£607	£607	£0
Space heating	£31	£31	£0
Water heating	£545	£545	£0
Lighting	£31	£31	£0
Generated (PV)	-£98	-£98	£0
Total cost of fuels	£509	£509	£0
Total cost of uses	£509	£509	£0
Delivered energy	39 kWh/m²	39 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	63 kWh/m²	63 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.8100 (1b)	x	2.4000 (2b)	=	117.1440	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.8100					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	117.1440	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.2900	1.2357	7.7728			(27)
External Wall 1	14.1700	6.2900	7.8800	0.1400	1.1032	14.0000	110.3200	(29a)
Total net area of external elements Aum(A, m2)			14.1700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	8.8760			(33)
Party Wall 1			24.8400	0.0000	0.0000	20.0000	496.8000	(32)
Wall to corridor			39.0100	0.0000	0.0000	20.0000	780.2000	(32)
Party Floor 1			48.8100			80.0000	3904.8000	(32d)
Party Ceiling 1			48.8100			80.0000	3904.8000	(32b)
Internal Wall 1			72.6800			9.0000	654.1200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9851.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		201.8242 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.7100	0.0500	0.1355
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.2500	0.0700	0.3675
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	20.8400	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.2910 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	10.1670 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.1418	11.0295	10.9171	10.3554	10.2430	9.6813	9.6813	9.5689	9.9060	10.2430	10.4677	10.6924	(38)
Heat transfer coeff	21.3088	21.1965	21.0841	20.5224	20.4100	19.8483	19.8483	19.7360	20.0730	20.4100	20.6347	20.8594	(39)
Average = Sum(39)m / 12 =												20.4943	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4366	0.4343	0.4320	0.4205	0.4182	0.4066	0.4066	0.4043	0.4112	0.4182	0.4228	0.4274	(40)
HLP (average)												0.4199	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.6551 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
71.4595	70.3856	68.8207	65.8266	63.6170	61.1529	59.7523	61.3053	63.0077	65.6534	68.7119	71.1857	(42a)

Hot water usage for baths

22.4723	22.1385	21.6685	20.8020	20.1531	19.4336	19.0450	19.5117	20.0198	20.7897	21.6741	22.3963	(42b)

Hot water usage for other uses

31.5802	30.4318	29.2834	28.1350	26.9867	25.8383	25.8383	26.9867	28.1350	29.2834	30.4318	31.5802	(42c)

Average daily hot water use (litres/day)		115.4278 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	125.5119	122.9558	119.7726	114.7636	110.7568	106.4248	104.6356	107.8037	111.1626	115.7265	120.8177	125.1621	(44)
Energy conte	198.7801	175.0875	184.0861	157.1056	149.0999	130.8617	126.5476	133.4834	137.0746	157.0398	172.1270	195.9736	(45)
Energy content (annual)										Total = Sum(45)m =		1917.2669	

Distribution loss (46)m = 0.15 x (45)m

29.8170	26.2631	27.6129	23.5658	22.3650	19.6293	18.9821	20.0225	20.5612	23.5560	25.8191	29.3960	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
									Total per year (kWh/year) = Sum(64)m =		2164.2989	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

82.8790	73.3769	77.9933	68.4808	66.3603	59.7547	58.8617	61.1679	61.8205	69.0004	73.4754	81.9459	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	17.4855	15.5304	12.6302	9.5619	7.1476	6.0343	6.5203	8.4753	11.3756	14.4439	16.8582	17.9715	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	215.1398	217.3723	211.7465	199.7699	184.6516	170.4425	160.9500	158.7175	164.3433	176.3199	191.4382	205.6473	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	(71)
Water heating gains (Table 5)													
	111.3965	109.1918	104.8296	95.1122	89.1940	82.9927	79.1152	82.2149	85.8618	92.7424	102.0492	110.1423	(72)
Total internal gains													
	423.7103	421.7830	408.8948	384.1325	360.6817	339.1579	326.2739	329.0962	341.2691	363.1946	390.0340	413.4494	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.2900	11.2829	0.6300	0.8270	0.7700	25.6243	(75)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	25.6243	52.1590	93.9740	154.3323	207.4529	221.1667	206.8969	164.9406	114.5088	63.7425	32.2420	20.9261	(83)
Total gains	449.3346	473.9420	502.8688	538.4647	568.1345	560.3246	533.1709	494.0368	455.7778	426.9371	422.2760	434.3755	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	128.4162	129.0969	129.7848	133.3373	134.0712	137.8657	137.8657	138.6505	136.3224	134.0712	132.6113	131.1828	
alpha	9.5611	9.6065	9.6523	9.8892	9.9381	10.1910	10.1910	10.2434	10.0882	9.9381	9.8408	9.7455	
util living area	0.7726	0.7112	0.6060	0.4610	0.3341	0.2267	0.1638	0.1838	0.3039	0.4969	0.6743	0.7854	(86)
MIT	20.9734	20.9871	20.9970	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9997	20.9936	20.9715	(87)
Th 2	20.5793	20.5815	20.5836	20.5943	20.5964	20.6071	20.6071	20.6093	20.6028	20.5964	20.5921	20.5879	(88)
util rest of house	0.7562	0.6942	0.5890	0.4456	0.3196	0.2128	0.1492	0.1682	0.2864	0.4777	0.6555	0.7694	(89)
MIT 2	20.5513	20.5682	20.5806	20.5941	20.5964	20.6071	20.6071	20.6093	20.6028	20.5961	20.5859	20.5578	(90)
Living area fraction										fLA = Living area / (4) =		0.5530	(91)
MIT	20.7847	20.7999	20.8108	20.8184	20.8196	20.8244	20.8244	20.8253	20.8225	20.8193	20.8113	20.7866	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7847	20.7999	20.8108	20.8184	20.8196	20.8244	20.8244	20.8253	20.8225	20.8193	20.8113	20.7866	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7643	0.7031	0.5983	0.4541	0.3276	0.2205	0.1573	0.1768	0.2961	0.4883	0.6657	0.7772	(94)
Useful gains	343.4042	333.2384	300.8562	244.5404	186.1291	123.5433	83.8467	87.3382	134.9394	208.4897	281.0919	337.5907	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	351.2699	337.0213	301.7319	244.5949	186.1310	123.5433	83.8467	87.3382	134.9399	208.5761	282.9300	345.9870	(97)
Space heating kWh	5.8521	2.5421	0.6515	0.0392	0.0014	0.0000	0.0000	0.0000	0.0000	0.0643	1.3235	6.2469	(98a)
Space heating requirement - total per year (kWh/year)												16.7210	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	5.8521	2.5421	0.6515	0.0392	0.0014	0.0000	0.0000	0.0000	0.0000	0.0643	1.3235	6.2469	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												16.7210	
Space heating per m2										(98c) / (4) =		0.3426	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	5.8521	2.5421	0.6515	0.0392	0.0014	0.0000	0.0000	0.0000	0.0000	0.0643	1.3235	6.2469	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	5.8521	2.5421	0.6515	0.0392	0.0014	0.0000	0.0000	0.0000	0.0000	0.0643	1.3235	6.2469	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.4966	7.6744	8.4966	8.2225	8.4966	8.2225	8.4966	8.4966	8.2225	8.4966	8.2225	8.4966	(231)
Lighting	15.3049	12.2782	11.0551	8.0995	6.2563	5.1114	5.7072	7.4184	9.6358	12.6427	14.2798	15.7303	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.6124	-18.5300	-30.3052	-38.4596	-45.4028	-43.7828	-43.0940	-38.8073	-31.5720	-22.8790	-13.4504	-9.7805	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.2732	-5.2742	-11.6436	-19.3564	-27.0799	-27.8299	-27.4302	-22.1697	-15.1176	-7.9609	-3.1514	-1.7472	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	16.7210	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2164.2989	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	100.0410	(230a)
Total electricity for the above, kWh/year	100.0410	(231)
Electricity for lighting (calculated in Appendix L)	123.5196	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-518.7101	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1885.8704	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	16.7210	16.4900	2.7573	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	16.4900	356.8929	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	100.0410	16.4900	16.4968	(249)
Energy for lighting	123.5196	16.4900	20.3684	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.6760	16.4900	-57.3318	
PV Unit electricity exported	-171.0341	5.5900	-9.5608	
Total			-66.8926	(252)
Total energy cost			329.6227	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2649	(257)
SAP value	79.4953	
SAP rating (Section 12)	79	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	16.7210	0.1611	2.6929	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2164.2989	0.1413	305.7097	(264)
Space and water heating			308.4027	(265)
Pumps, fans and electric keep-hot	100.0410	0.1387	13.8769	(267)
Energy for lighting	123.5196	0.1443	17.8277	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.6760	0.1322	-45.9596	
PV Unit electricity exported	-171.0341	0.1234	-21.1138	
Total			-67.0733	(269)
Total CO2, kg/year			273.0339	(272)
CO2 emissions per m2			5.5900	(273)
EI value			96.0999	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.8100	(1b)	x 2.4000	(2b) =	117.1440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.8100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		117.1440	(5)

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2. Ventilation rate

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m3 per hour

Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												72.0000	(23c)
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.2900	1.2357	7.7728			(27)
External Wall 1	14.1700	6.2900	7.8800	0.1400	1.1032	14.0000	110.3200	(29a)
Total net area of external elements Aum(A, m2)			14.1700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		8.8760			(33)
Party Wall 1			24.8400	0.0000	0.0000	20.0000	496.8000	(32)
Wall to corridor			39.0100	0.0000	0.0000	20.0000	780.2000	(32)
Party Floor 1			48.8100			80.0000	3904.8000	(32d)
Party Ceiling 1			48.8100			80.0000	3904.8000	(32b)
Internal Wall 1			72.6800			9.0000	654.1200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9851.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		201.8242 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.7100	0.0500	0.1355
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.2500	0.0700	0.3675
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	20.8400	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.2910 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	10.1670 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.2542	11.2542	11.0295	10.3554	10.2430	9.7936	9.5689	9.5689	10.0183	10.5801	10.8048	10.6924	(38)
Heat transfer coeff	21.4212	21.4212	21.1965	20.5224	20.4100	19.9607	19.7360	19.7360	20.1854	20.7471	20.9718	20.8594	(39)
Average = Sum(39)m / 12 =												20.5973	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4389	0.4389	0.4343	0.4205	0.4182	0.4089	0.4043	0.4043	0.4135	0.4251	0.4297	0.4274	(40)
HLP (average)												0.4220	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.6551 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
71.4595	70.3856	68.8207	65.8266	63.6170	61.1529	59.7523	61.3053	63.0077	65.6534	68.7119	71.1857	(42a)

Hot water usage for baths

22.4723	22.1385	21.6685	20.8020	20.1531	19.4336	19.0450	19.5117	20.0198	20.7897	21.6741	22.3963	(42b)

Hot water usage for other uses

31.5802	30.4318	29.2834	28.1350	26.9867	25.8383	25.8383	26.9867	28.1350	29.2834	30.4318	31.5802	(42c)

Average daily hot water use (litres/day)		115.4278 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	125.5119	122.9558	119.7726	114.7636	110.7568	106.4248	104.6356	107.8037	111.1626	115.7265	120.8177	125.1621	(44)
Energy conte	198.7801	175.0875	184.0861	157.1056	149.0999	130.8617	126.5476	133.4834	137.0746	157.0398	172.1270	195.9736	(45)
Energy content (annual)										Total = Sum(45)m =		1917.2669	
Distribution loss (46)m = 0.15 x (45)m													
	29.8170	26.2631	27.6129	23.5658	22.3650	19.6293	18.9821	20.0225	20.5612	23.5560	25.8191	29.3960	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544 (64)
									Total per year (kWh/year) = Sum(64)m =			2164.2989 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						0.0000 (64a)
Heat gains from water heating, kWh/month												
	82.8790	73.3769	77.9933	68.4808	66.3603	59.7547	58.8617	61.1679	61.8205	69.0004	73.4754	81.9459 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	17.4855	15.5304	12.6302	9.5619	7.1476	6.0343	6.5203	8.4753	11.3756	14.4439	16.8582	17.9715	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	215.1398	217.3723	211.7465	199.7699	184.6516	170.4425	160.9500	158.7175	164.3433	176.3199	191.4382	205.6473	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	(71)
Water heating gains (Table 5)													
	111.3965	109.1918	104.8296	95.1122	89.1940	82.9927	79.1152	82.2149	85.8618	92.7424	102.0492	110.1423	(72)
Total internal gains													
	423.7103	421.7830	408.8948	384.1325	360.6817	339.1579	326.2739	329.0962	341.2691	363.1946	390.0340	413.4494	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.2900	10.0309	0.6300	0.8270	0.7700	22.7809	(75)

Solar gains	22.7809	49.3199	92.7016	160.6228	214.7931	223.1785	211.1088	162.9125	112.0170	59.8425	29.4243	19.0490	(83)
Total gains	446.4911	471.1029	501.5964	544.7552	575.4748	562.3364	537.3828	492.0087	453.2861	423.0371	419.4582	432.4984	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	127.7427	127.7427	129.0969	133.3373	134.0712	137.0897	138.6505	138.6505	135.5637	131.8932	130.4800	131.1828	
alpha	9.5162	9.5162	9.6065	9.8892	9.9381	10.1393	10.2434	10.2434	10.0376	9.7929	9.6987	9.7455	
util living area													
	0.7948	0.7453	0.6471	0.4933	0.3653	0.2769	0.2240	0.2487	0.3651	0.5534	0.7114	0.8068	(86)
MIT	20.9651	20.9797	20.9943	20.9996	21.0000	21.0000	21.0000	21.0000	21.0000	20.9990	20.9890	20.9634	(87)
Th 2	20.5772	20.5772	20.5815	20.5943	20.5964	20.6050	20.6093	20.6093	20.6007	20.5900	20.5857	20.5879	(88)
util rest of house													
	0.7789	0.7287	0.6302	0.4781	0.3510	0.2628	0.2097	0.2330	0.3474	0.5335	0.6926	0.7915	(89)
MIT 2	20.5401	20.5560	20.5757	20.5939	20.5964	20.6050	20.6093	20.6093	20.6007	20.5891	20.5747	20.5487	(90)
Living area fraction										fLA = Living area / (4) =		0.5530	(91)
MIT	20.7751	20.7903	20.8072	20.8182	20.8196	20.8234	20.8253	20.8253	20.8215	20.8158	20.8038	20.7780	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7751	20.7903	20.8072	20.8182	20.8196	20.8234	20.8253	20.8253	20.8215	20.8158	20.8038	20.7780	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7864	0.7371	0.6393	0.4865	0.3589	0.2706	0.2176	0.2417	0.3572	0.5445	0.7025	0.7986	(94)
Useful gains	351.1385	347.2445	320.6771	265.0035	206.5358	152.1681	116.9421	118.9157	161.9131	230.3437	294.6735	345.4051	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	361.4839	353.2416	322.3390	265.1134	206.5408	152.1683	116.9421	118.9157	161.9165	230.6198	297.8783	356.2377	(97)
Space heating kWh													
	7.6970	4.0300	1.2365	0.0791	0.0037	0.0000	0.0000	0.0000	0.0000	0.2055	2.3075	8.0594	(98a)
Space heating requirement - total per year (kWh/year)												23.6187	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	7.6970	4.0300	1.2365	0.0791	0.0037	0.0000	0.0000	0.0000	0.0000	0.2055	2.3075	8.0594	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												23.6187	
Space heating per m2											(98c) / (4) =	0.4839	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement												

	7.6970	4.0300	1.2365	0.0791	0.0037	0.0000	0.0000	0.0000	0.0000	0.2055	2.3075	8.0594 (98)
Space heating efficiency (main heating system 1)												
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)												
	7.6970	4.0300	1.2365	0.0791	0.0037	0.0000	0.0000	0.0000	0.0000	0.2055	2.3075	8.0594 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	8.4966	7.6744	8.4966	8.2225	8.4966	8.2225	8.4966	8.4966	8.2225	8.4966	8.2225	8.4966 (231)
Lighting	15.3049	12.2782	11.0551	8.0995	6.2563	5.1114	5.7072	7.4184	9.6358	12.6427	14.2798	15.7303 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-10.5135	-17.8235	-30.3039	-40.1107	-47.0328	-44.4324	-44.1129	-38.8193	-31.3606	-21.9085	-12.4971	-9.0348 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-1.9317	-4.9317	-11.6305	-20.8679	-28.9016	-28.6057	-28.6546	-22.1822	-14.9388	-7.3951	-2.7904	-1.5346 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	23.6187 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2164.2989 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	100.0410 (230a)
Total electricity for the above, kWh/year	100.0410 (231)
Electricity for lighting (calculated in Appendix L)	123.5196 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-522.3147 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1889.1634 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	23.6187	25.1600	5.9425	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	25.1600	544.5376	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	100.0410	25.1600	25.1703	(249)
Energy for lighting	123.5196	25.1600	31.0775	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.9499	25.1600	-87.5442	
PV Unit electricity exported	-174.3648	5.8100	-10.1306	
Total			-97.6748	(252)
Total energy cost			509.0531	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	23.6187	0.1605	3.7905	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2164.2989	0.1413	305.7097	(264)
Space and water heating			309.5002	(265)
Pumps, fans and electric keep-hot	100.0410	0.1387	13.8769	(267)
Energy for lighting	123.5196	0.1443	17.8277	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.9499	0.1319	-45.8876	
PV Unit electricity exported	-174.3648	0.1230	-21.4411	
Total			-67.3287	(269)
Total CO2, kg/year			273.8761	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year

Space heating - main system 1	23.6187	1.5940	37.6472	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	1.5223	3294.7406	(278)
Space and water heating			3332.3878	(279)
Pumps, fans and electric keep-hot	100.0410	1.5128	151.3420	(281)
Energy for lighting	123.5196	1.5338	189.4585	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.9499	1.4873	-517.4911	
PV Unit electricity exported	-174.3648	0.4513	-78.6883	
Total			-596.1795	(283)
Total Primary energy kWh/year			3077.0088	(286)

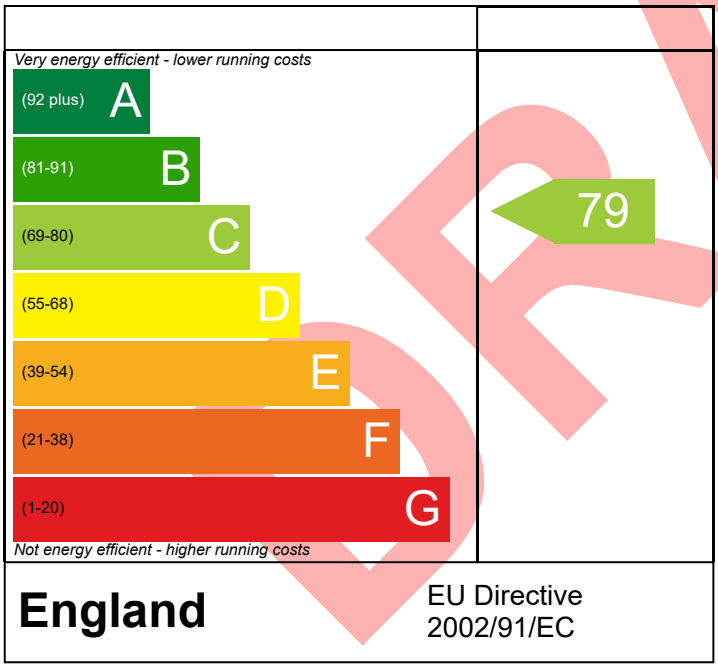
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	48.81 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

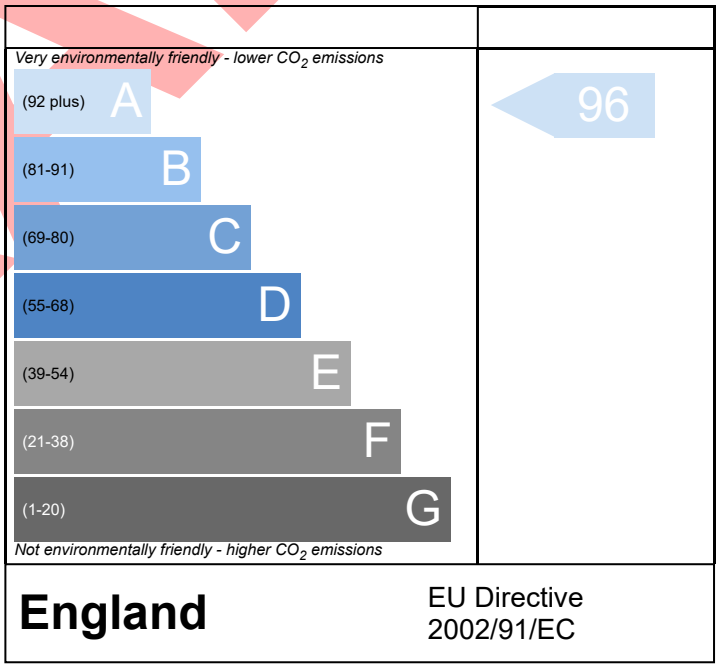
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:45

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	51 m^2
Site Reference	Unit 76 L04_Copy	Plot Reference	Unit 76 L04_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.09 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	5.38 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*60.3 kWh$_{PE}$/m^2*	
Dwelling primary energy	60.59 kWh$_{PE}$/m^2	FAIL
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*12.7 kWh/m^2*	
Dwelling fabric energy efficiency	11.8 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	7.91	0.14 **(!)**
Party wall: Party Wall (1)	47.52	0 **(!)**
Party wall: Party Wall (2)	15.79	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SE, Opening Type 1	7.88	South East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.67 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 76 L04_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 76 L04_Copy	**Prop Type Ref**	Unit 76 L04
Property			

SAP Rating	80 C	**DER**	5.38	**TER**	11.09
Environmental	96 A	**% DER < TER**			51.49
CO_2 Emissions (t/year)	0.28	**DFEE**	11.77	**TFEE**	12.71
Compliance Check	See BREL	**% DFEE < TFEE**			7.41
% DPER < TPER	-0.48	**DPER**	60.59	**TPER**	60.30

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.4800 (1b)	x	2.4000 (2b)	=	123.5520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.4800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	123.5520	(5)

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2. Ventilation rate

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	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	15.7900	7.8800	7.9100	0.1400	1.1074	14.0000	110.7400	(29a)
Total net area of external elements Aum(A, m2)			15.7900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.8450			(33)
Party Wall 1			47.5200	0.0000	0.0000	20.0000	950.4000	(32)
Wall to corridor			15.7900	0.0000	0.0000	20.0000	315.8000	(32)
Party Floor 1			51.4800			80.0000	4118.4000	(32d)
Party Ceiling 1			51.4800			80.0000	4118.4000	(32b)
Internal Wall 1			80.1900			9.0000	721.7100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10335.4500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		200.7663 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695

E4 Jamb	9.2800	0.0500	0.4640	
E7 Party floor between dwellings (in blocks of flats)	5.8500	0.0700	0.4095	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.4500	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.3670 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 12.2120 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.7513	11.6328	11.5143	10.9218	10.8033	10.2109	10.2109	10.0924	10.4479	10.8033	11.0403	11.2773	(38)
Heat transfer coeff	23.9633	23.8448	23.7264	23.1339	23.0154	22.4229	22.4229	22.3044	22.6599	23.0154	23.2524	23.4894	(39)

Average = Sum(39)m / 12 = 23.1043

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4655	0.4632	0.4609	0.4494	0.4471	0.4356	0.4356	0.4333	0.4402	0.4471	0.4517	0.4563	(40)
HLP (average)												0.4488	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7337 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.2716	72.1705	70.5659	67.4959	65.2303	62.7037	61.2676	62.8600	64.6056	67.3184	70.4543	72.9909	(42a)
Hot water usage for baths	23.0390	22.6968	22.2150	21.3266	20.6614	19.9237	19.5253	20.0037	20.5247	21.3140	22.2207	22.9611	(42b)
Hot water usage for other uses	32.3851	31.2075	30.0298	28.8522	27.6746	26.4969	26.4969	27.6746	28.8522	30.0298	31.2075	32.3851	(42c)

Average daily hot water use (litres/day) 118.3558 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.6957	126.0748	122.8108	117.6747	113.5662	109.1243	107.2898	110.5383	113.9825	118.6622	123.8825	128.3371	(44)
Energy conte	203.8226	179.5288	188.7556	161.0907	152.8819	134.1811	129.7577	136.8695	140.5518	161.0235	176.4934	200.9449	(45)

Energy content (annual) Total = Sum(45)m = 1965.9015

Distribution loss (46)m = 0.15 x (45)m	30.5734	26.9293	28.3133	24.1636	22.9323	20.1272	19.4636	20.5304	21.0828	24.1535	26.4740	30.1417	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)

Total per year (kWh/year) = Sum(64)m = 2212.9335 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	84.5557	74.8537	79.5459	69.8059	67.6179	60.8584	59.9291	62.2937	62.9767	70.3250	74.9273	83.5988	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.7487	15.7643	12.8204	9.7058	7.2552	6.1252	6.6185	8.6029	11.5468	14.6613	17.1120	18.2420	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	225.4877	227.8276	221.9312	209.3786	193.5331	178.6406	168.6914	166.3516	172.2479	184.8006	200.6461	215.5386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	(71)
Water heating gains (Table 5)	113.6501	111.3894	106.9165	96.9526	90.8842	84.5256	80.5498	83.7281	87.4676	94.5228	104.0656	112.3640	(72)
Total internal gains	438.6972	436.7919	423.4788	397.8477	373.4832	351.1020	337.6704	340.4934	353.0731	375.7954	403.6344	427.9553	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(77)

Solar gains	104.6841	178.3157	243.9793	302.3022	338.6036	336.1550	324.0893	297.0068	264.1780	197.0768	125.3874	89.5877	(83)
Total gains	543.3813	615.1076	667.4580	700.1498	712.0869	687.2570	661.7597	637.5001	617.2510	572.8722	529.0217	517.5431	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	119.8063	120.4016	121.0029	124.1019	124.7408	128.0368	128.0368	128.7170	126.6977	124.7408	123.4694	122.2237	
alpha	8.9871	9.0268	9.0669	9.2735	9.3161	9.5358	9.5358	9.5811	9.4465	9.3161	9.2313	9.1482	
util living area													
	0.7234	0.6208	0.5148	0.3998	0.3006	0.2088	0.1491	0.1609	0.2533	0.4178	0.6084	0.7463	(86)
MIT	20.9795	20.9940	20.9988	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9999	20.9961	20.9757	(87)
Th 2	20.5526	20.5547	20.5568	20.5675	20.5696	20.5802	20.5802	20.5824	20.5760	20.5696	20.5653	20.5611	(88)
util rest of house													
	0.7062	0.6042	0.4992	0.3855	0.2867	0.1951	0.1349	0.1463	0.2377	0.4005	0.5899	0.7294	(89)
MIT 2	20.5313	20.5486	20.5557	20.5674	20.5696	20.5802	20.5802	20.5824	20.5760	20.5695	20.5615	20.5356	(90)
Living area fraction										fLA = Living area / (4) =		0.5577	(91)
MIT	20.7812	20.7970	20.8028	20.8086	20.8096	20.8143	20.8143	20.8153	20.8125	20.8095	20.8039	20.7811	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7812	20.7970	20.8028	20.8086	20.8096	20.8143	20.8143	20.8153	20.8125	20.8095	20.8039	20.7811	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7151	0.6132	0.5079	0.3934	0.2944	0.2028	0.1428	0.1545	0.2464	0.4101	0.6001	0.7379	(94)
Useful gains	388.5487	377.2072	338.9911	275.4626	209.6597	139.3436	94.4978	98.4804	152.1033	234.9415	317.4656	381.9023	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	394.9458	379.0622	339.3534	275.4919	209.6614	139.3436	94.4978	98.4804	152.1035	234.9759	318.6483	389.4786	(97)
Space heating kWh													
	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(98a)
Space heating requirement - total per year (kWh/year)												12.8118	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												12.8118	
Space heating per m2											(98c) / (4) =	0.2489	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9614	8.0942	8.9614	8.6723	8.9614	8.6723	8.9614	8.9614	8.6723	8.9614	8.6723	8.9614	(231)
Lighting	15.5353	12.4630	11.2216	8.2214	6.3505	5.1884	5.7931	7.5301	9.7808	12.8330	14.4948	15.9671	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.3128	-19.6230	-32.0667	-40.6524	-47.9480	-46.2189	-45.4896	-40.9865	-33.3753	-24.2196	-14.2561	-10.3736	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4545	-5.6926	-12.5456	-20.8344	-29.1368	-29.9406	-29.5123	-23.8619	-16.2788	-8.5783	-3.3998	-1.8860	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	12.8118	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2212.9335	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	105.5134	(230a)
Total electricity for the above, kWh/year	105.5134	(231)
Electricity for lighting (calculated in Appendix L)	125.3792	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-551.6441	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1904.9938	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	12.8118	16.4900	2.1127	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	16.4900	364.9127	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	105.5134	16.4900	17.3992	(249)
Energy for lighting	125.3792	16.4900	20.6750	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.5224	16.4900	-60.6044	
PV Unit electricity exported	-184.1216	5.5900	-10.2924	
Total			-70.8968	(252)
Total energy cost			334.2027	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2470	(257)
SAP value		79.7857	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	12.8118	0.1616	2.0705	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2212.9335	0.1413	312.5953	(264)
Space and water heating			314.6658	(265)
Pumps, fans and electric keep-hot	105.5134	0.1387	14.6360	(267)
Energy for lighting	125.3792	0.1443	18.0961	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.5224	0.1322	-48.5906	
PV Unit electricity exported	-184.1216	0.1235	-22.7330	
Total			-71.3237	(269)
Total CO2, kg/year			276.0743	(272)
CO2 emissions per m2			5.3600	(273)
EI value			96.1656	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		51.4800 (1b)	x	2.4000 (2b)	=	123.5520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.4800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	123.5520	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	15.7900	7.8800	7.9100	0.1400	1.1074	14.0000	110.7400	(29a)
Total net area of external elements Aum(A, m2)			15.7900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.8450			(33)
Party Wall 1			47.5200	0.0000	0.0000	20.0000	950.4000	(32)
Wall to corridor			15.7900	0.0000	0.0000	20.0000	315.8000	(32)
Party Floor 1			51.4800			80.0000	4118.4000	(32d)
Party Ceiling 1			51.4800			80.0000	4118.4000	(32b)
Internal Wall 1			80.1900			9.0000	721.7100	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 10335.4500 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 200.7663 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.8500	0.0700	0.4095
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.4500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.3670 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 12.2120 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.8698	11.8698	11.6328	10.9218	10.8033	10.3294	10.0924	10.0924	10.5664	11.1588	11.3958	11.2773	(38)
Heat transfer coeff	24.0818	24.0818	23.8448	23.1339	23.0154	22.5414	22.3044	22.3044	22.7784	23.3709	23.6079	23.4894	(39)

Average = Sum(39)m / 12 = 23.2129

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4678	0.4678	0.4632	0.4494	0.4471	0.4379	0.4333	0.4333	0.4425	0.4540	0.4586	0.4563	(40)
HLP (average)												0.4509	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7337 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.2716	72.1705	70.5659	67.4959	65.2303	62.7037	61.2676	62.8600	64.6056	67.3184	70.4543	72.9909	(42a)
Hot water usage for baths	23.0390	22.6968	22.2150	21.3266	20.6614	19.9237	19.5253	20.0037	20.5247	21.3140	22.2207	22.9611	(42b)
Hot water usage for other uses	32.3851	31.2075	30.0298	28.8522	27.6746	26.4969	26.4969	27.6746	28.8522	30.0298	31.2075	32.3851	(42c)

Average daily hot water use (litres/day) 118.3558 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.6957	126.0748	122.8108	117.6747	113.5662	109.1243	107.2898	110.5383	113.9825	118.6622	123.8825	128.3371	(44)
Energy conte	203.8226	179.5288	188.7556	161.0907	152.8819	134.1811	129.7577	136.8695	140.5518	161.0235	176.4934	200.9449	(45)
Energy content (annual)										Total = Sum(45)m =		1965.9015	
Distribution loss (46)m = 0.15 x (45)m	30.5734	26.9293	28.3133	24.1636	22.9323	20.1272	19.4636	20.5304	21.0828	24.1535	26.4740	30.1417	(46)

Water storage loss:

Store volume 143.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)

Temperature factor from Table 2b 0.6000 (49)

Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
										Total per year (kWh/year) = Sum(64)m =		2212.9335	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	84.5557	74.8537	79.5459	69.8059	67.6179	60.8584	59.9291	62.2937	62.9767	70.3250	74.9273	83.5988	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	17.7487	15.7643	12.8204	9.7058	7.2552	6.1252	6.6185	8.6029	11.5468	14.6613	17.1120	18.2420	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	225.4877	227.8276	221.9312	209.3786	193.5331	178.6406	168.6914	166.3516	172.2479	184.8006	200.6461	215.5386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	(71)
Water heating gains (Table 5)													
	113.6501	111.3894	106.9165	96.9526	90.8842	84.5256	80.5498	83.7281	87.4676	94.5228	104.0656	112.3640	(72)
Total internal gains													
	438.6972	436.7919	423.4788	397.8477	373.4832	351.1020	337.6704	340.4934	353.0731	375.7954	403.6344	427.9553	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(77)

Solar gains	95.2051	173.0844	247.4999	322.5774	357.6553	345.0938	336.8383	300.1802	265.5901	190.1488	117.1921	83.3220	(83)
Total gains	533.9023	609.8763	670.9786	720.4250	731.1385	696.1958	674.5087	640.6735	618.6632	565.9442	520.8265	511.2773	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	119.2167	119.2167	120.4016	124.1019	124.7408	127.3637	128.7170	128.7170	126.0386	122.8434	121.6103	122.2237	
alpha	8.9478	8.9478	9.0268	9.2735	9.3161	9.4909	9.5811	9.5811	9.4026	9.1896	9.1074	9.1482	
util living area													
	0.7526	0.6539	0.5462	0.4206	0.3242	0.2525	0.2017	0.2158	0.3019	0.4664	0.6480	0.7727	(86)
MIT	20.9712	20.9903	20.9979	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9996	20.9929	20.9672	(87)
Th 2	20.5504	20.5504	20.5547	20.5675	20.5696	20.5781	20.5824	20.5824	20.5738	20.5632	20.5589	20.5611	(88)
util rest of house													
	0.7357	0.6373	0.5306	0.4067	0.3107	0.2389	0.1879	0.2013	0.2862	0.4484	0.6291	0.7564	(89)
MIT 2	20.5201	20.5405	20.5526	20.5673	20.5696	20.5781	20.5824	20.5824	20.5738	20.5629	20.5519	20.5263	(90)
Living area fraction										fLA = Living area / (4) =		0.5577	(91)
MIT	20.7716	20.7914	20.8010	20.8085	20.8096	20.8134	20.8153	20.8153	20.8115	20.8064	20.7978	20.7722	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7716	20.7914	20.8010	20.8085	20.8096	20.8134	20.8153	20.8153	20.8115	20.8064	20.7978	20.7722	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7441	0.6462	0.5392	0.4144	0.3182	0.2465	0.1956	0.2094	0.2950	0.4585	0.6394	0.7643	(94)
Useful gains	397.2723	394.1170	361.8210	298.5746	232.6729	171.6165	131.9370	134.1674	182.4879	259.4584	332.9973	390.7730	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	406.3003	397.1421	362.4645	298.6242	232.6766	171.6167	131.9370	134.1674	182.4893	259.5673	335.1804	401.0157	(97)
Space heating kWh													
	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205	(98a)
Space heating requirement - total per year (kWh/year)												18.5404	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												18.5404	
Space heating per m2										(98c) / (4) =		0.3601	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9614	8.0942	8.9614	8.6723	8.9614	8.6723	8.9614	8.9614	8.6723	8.9614	8.6723	8.9614	(231)

Lighting	15.5353	12.4630	11.2216	8.2214	6.3505	5.1884	5.7931	7.5301	9.7808	12.8330	14.4948	15.9671 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-11.1496	-18.8721	-32.0603	-42.3899	-49.6609	-46.9012	-46.5595	-40.9992	-33.1527	-23.1943	-13.2464	-9.5840 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.0858	-5.3278	-12.5367	-22.4603	-31.0947	-30.7742	-30.8282	-23.8754	-16.0865	-7.9699	-3.0116	-1.6564 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	18.5404 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2212.9335 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	105.5134 (230a)
Total electricity for the above, kWh/year	105.5134 (231)
Electricity for lighting (calculated in Appendix L)	125.3792 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-555.4776 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1906.8888 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	18.5404	25.1600	4.6648	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	25.1600	556.7741	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	105.5134	25.1600	26.5472	(249)
Energy for lighting	125.3792	25.1600	31.5454	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.7700	25.1600	-92.5309	
PV Unit electricity exported	-187.7076	5.8100	-10.9058	
Total			-103.4367	(252)
Total energy cost			516.0946	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	18.5404	0.1612	2.9893	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2212.9335	0.1413	312.5953	(264)
Space and water heating			315.5847	(265)
Pumps, fans and electric keep-hot	105.5134	0.1387	14.6360	(267)
Energy for lighting	125.3792	0.1443	18.0961	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.7700	0.1319	-48.5087	
PV Unit electricity exported	-187.7076	0.1230	-23.0860	
Total			-71.5947	(269)
Total CO2, kg/year			276.7220	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	18.5404	1.5966	29.6024	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	1.5223	3368.8373	(278)
Space and water heating			3398.4396	(279)
Pumps, fans and electric keep-hot	105.5134	1.5128	159.6207	(281)
Energy for lighting	125.3792	1.5338	192.3107	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.7700	1.4873	-546.9961	
PV Unit electricity exported	-187.7076	0.4514	-84.7250	
Total			-631.7212	(283)
Total Primary energy kWh/year			3118.6499	(286)

SAP 10 EPC IMPROVEMENTS

Unit 76 L04_Copy

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 80
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£620	£620	£0
Space heating	£31	£31	£0
Water heating	£557	£557	£0
Lighting	£32	£32	£0
Generated (PV)	-£103	-£103	£0
Total cost of fuels	£517	£517	£0
Total cost of uses	£517	£517	£0
Delivered energy	37 kWh/m²	37 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	61 kWh/m²	61 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.4800 (1b)	x	2.4000 (2b)	=	123.5520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.4800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	123.5520	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	15.7900	7.8800	7.9100	0.1400	1.1074	14.0000	110.7400	(29a)
Total net area of external elements Aum(A, m2)			15.7900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	10.8450			(33)
Party Wall 1			47.5200	0.0000	0.0000	20.0000	950.4000	(32)
Wall to corridor			15.7900	0.0000	0.0000	20.0000	315.8000	(32)
Party Floor 1			51.4800			80.0000	4118.4000	(32d)
Party Ceiling 1			51.4800			80.0000	4118.4000	(32b)
Internal Wall 1			80.1900			9.0000	721.7100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10335.4500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		200.7663 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.8500	0.0700	0.4095
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.4500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.3670 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	12.2120 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.7513	11.6328	11.5143	10.9218	10.8033	10.2109	10.2109	10.0924	10.4479	10.8033	11.0403	11.2773	(38)
Heat transfer coeff	23.9633	23.8448	23.7264	23.1339	23.0154	22.4229	22.4229	22.3044	22.6599	23.0154	23.2524	23.4894	(39)
Average = Sum(39)m / 12 =												23.1043	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4655	0.4632	0.4609	0.4494	0.4471	0.4356	0.4356	0.4333	0.4402	0.4471	0.4517	0.4563	(40)
HLP (average)												0.4488	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7337	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.2716	72.1705	70.5659	67.4959	65.2303	62.7037	61.2676	62.8600	64.6056	67.3184	70.4543	72.9909	(42a)

Hot water usage for baths

23.0390	22.6968	22.2150	21.3266	20.6614	19.9237	19.5253	20.0037	20.5247	21.3140	22.2207	22.9611	(42b)

Hot water usage for other uses

32.3851	31.2075	30.0298	28.8522	27.6746	26.4969	26.4969	27.6746	28.8522	30.0298	31.2075	32.3851	(42c)

Average daily hot water use (litres/day)	118.3558	(43)

Daily hot water use

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
128.6957	126.0748	122.8108	117.6747	113.5662	109.1243	107.2898	110.5383	113.9825	118.6622	123.8825	128.3371	(44)
Energy conte 203.8226	179.5288	188.7556	161.0907	152.8819	134.1811	129.7577	136.8695	140.5518	161.0235	176.4934	200.9449	(45)

Energy content (annual)	Total = Sum(45)m =	1965.9015

Distribution loss (46)m = 0.15 x (45)m

30.5734	26.9293	28.3133	24.1636	22.9323	20.1272	19.4636	20.5304	21.0828	24.1535	26.4740	30.1417	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)

Total per year (kWh/year) = Sum(64)m =	2212.9335	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000	(64a)

Heat gains from water heating, kWh/month

84.5557	74.8537	79.5459	69.8059	67.6179	60.8584	59.9291	62.2937	62.9767	70.3250	74.9273	83.5988	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.7487	15.7643	12.8204	9.7058	7.2552	6.1252	6.6185	8.6029	11.5468	14.6613	17.1120	18.2420	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	225.4877	227.8276	221.9312	209.3786	193.5331	178.6406	168.6914	166.3516	172.2479	184.8006	200.6461	215.5386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	(71)
Water heating gains (Table 5)	113.6501	111.3894	106.9165	96.9526	90.8842	84.5256	80.5498	83.7281	87.4676	94.5228	104.0656	112.3640	(72)
Total internal gains	438.6972	436.7919	423.4788	397.8477	373.4832	351.1020	337.6704	340.4934	353.0731	375.7954	403.6344	427.9553	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(77)

Solar gains	104.6841	178.3157	243.9793	302.3022	338.6036	336.1550	324.0893	297.0068	264.1780	197.0768	125.3874	89.5877 (83)
Total gains	543.3813	615.1076	667.4580	700.1498	712.0869	687.2570	661.7597	637.5001	617.2510	572.8722	529.0217	517.5431 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	119.8063	120.4016	121.0029	124.1019	124.7408	128.0368	128.0368	128.7170	126.6977	124.7408	123.4694	122.2237	
alpha	8.9871	9.0268	9.0669	9.2735	9.3161	9.5358	9.5358	9.5811	9.4465	9.3161	9.2313	9.1482	
util living area	0.7234	0.6208	0.5148	0.3998	0.3006	0.2088	0.1491	0.1609	0.2533	0.4178	0.6084	0.7463	(86)
MIT	20.9795	20.9940	20.9988	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9999	20.9961	20.9757	(87)
Th 2	20.5526	20.5547	20.5568	20.5675	20.5696	20.5802	20.5802	20.5824	20.5760	20.5696	20.5653	20.5611	(88)
util rest of house	0.7062	0.6042	0.4992	0.3855	0.2867	0.1951	0.1349	0.1463	0.2377	0.4005	0.5899	0.7294	(89)
MIT 2	20.5313	20.5486	20.5557	20.5674	20.5696	20.5802	20.5802	20.5824	20.5760	20.5695	20.5615	20.5356	(90)
Living area fraction									fLA = Living area / (4) =			0.5577	(91)
MIT	20.7812	20.7970	20.8028	20.8086	20.8096	20.8143	20.8143	20.8153	20.8125	20.8095	20.8039	20.7811	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7812	20.7970	20.8028	20.8086	20.8096	20.8143	20.8143	20.8153	20.8125	20.8095	20.8039	20.7811	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7151	0.6132	0.5079	0.3934	0.2944	0.2028	0.1428	0.1545	0.2464	0.4101	0.6001	0.7379	(94)
Useful gains	388.5487	377.2072	338.9911	275.4626	209.6597	139.3436	94.4978	98.4804	152.1033	234.9415	317.4656	381.9023	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	394.9458	379.0622	339.3534	275.4919	209.6614	139.3436	94.4978	98.4804	152.1035	234.9759	318.6483	389.4786	(97)
Space heating kWh	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(98a)
Space heating requirement - total per year (kWh/year)												12.8118	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												12.8118	
Space heating per m2											(98c) / (4) =	0.2489	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9614	8.0942	8.9614	8.6723	8.9614	8.6723	8.9614	8.9614	8.6723	8.9614	8.6723	8.9614	(231)
Lighting	15.5353	12.4630	11.2216	8.2214	6.3505	5.1884	5.7931	7.5301	9.7808	12.8330	14.4948	15.9671	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.3128	-19.6230	-32.0667	-40.6524	-47.9480	-46.2189	-45.4896	-40.9865	-33.3753	-24.2196	-14.2561	-10.3736	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4545	-5.6926	-12.5456	-20.8344	-29.1368	-29.9406	-29.5123	-23.8619	-16.2788	-8.5783	-3.3998	-1.8860	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												12.8118	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2212.9335	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	105.5134	(230a)
Total electricity for the above, kWh/year	105.5134	(231)
Electricity for lighting (calculated in Appendix L)	125.3792	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-551.6441	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1904.9938	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	12.8118	16.4900	2.1127	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	16.4900	364.9127	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	105.5134	16.4900	17.3992	(249)
Energy for lighting	125.3792	16.4900	20.6750	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.5224	16.4900	-60.6044	
PV Unit electricity exported	-184.1216	5.5900	-10.2924	
Total			-70.8968	(252)
Total energy cost			334.2027	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2470	(257)
SAP value		79.7857	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	12.8118	0.1616	2.0705	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2212.9335	0.1413	312.5953	(264)
Space and water heating			314.6658	(265)
Pumps, fans and electric keep-hot	105.5134	0.1387	14.6360	(267)
Energy for lighting	125.3792	0.1443	18.0961	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.5224	0.1322	-48.5906	
PV Unit electricity exported	-184.1216	0.1235	-22.7330	
Total			-71.3237	(269)
Total CO2, kg/year			276.0743	(272)
CO2 emissions per m2			5.3600	(273)
EI value			96.1656	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		51.4800 (1b)	x	2.4000 (2b)	=	123.5520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.4800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	123.5520	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	15.7900	7.8800	7.9100	0.1400	1.1074	14.0000	110.7400	(29a)
Total net area of external elements Aum(A, m2)			15.7900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	10.8450			(33)
Party Wall 1			47.5200	0.0000	0.0000	20.0000	950.4000	(32)
Wall to corridor			15.7900	0.0000	0.0000	20.0000	315.8000	(32)
Party Floor 1			51.4800			80.0000	4118.4000	(32d)
Party Ceiling 1			51.4800			80.0000	4118.4000	(32b)
Internal Wall 1			80.1900			9.0000	721.7100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10335.4500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		200.7663 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.8500	0.0700	0.4095
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.4500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.3670 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	12.2120 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.8698	11.8698	11.6328	10.9218	10.8033	10.3294	10.0924	10.0924	10.5664	11.1588	11.3958	11.2773	(38)
Heat transfer coeff	24.0818	24.0818	23.8448	23.1339	23.0154	22.5414	22.3044	22.3044	22.7784	23.3709	23.6079	23.4894	(39)
Average = Sum(39)m / 12 =												23.2129	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4678	0.4678	0.4632	0.4494	0.4471	0.4379	0.4333	0.4333	0.4425	0.4540	0.4586	0.4563	(40)
HLP (average)												0.4509	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.7337 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.2716	72.1705	70.5659	67.4959	65.2303	62.7037	61.2676	62.8600	64.6056	67.3184	70.4543	72.9909	(42a)

Hot water usage for baths

23.0390	22.6968	22.2150	21.3266	20.6614	19.9237	19.5253	20.0037	20.5247	21.3140	22.2207	22.9611	(42b)

Hot water usage for other uses

32.3851	31.2075	30.0298	28.8522	27.6746	26.4969	26.4969	27.6746	28.8522	30.0298	31.2075	32.3851	(42c)

Average daily hot water use (litres/day)		118.3558 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.6957	126.0748	122.8108	117.6747	113.5662	109.1243	107.2898	110.5383	113.9825	118.6622	123.8825	128.3371	(44)
Energy conte	203.8226	179.5288	188.7556	161.0907	152.8819	134.1811	129.7577	136.8695	140.5518	161.0235	176.4934	200.9449	(45)
Energy content (annual)										Total = Sum(45)m =		1965.9015	

Distribution loss (46)m = 0.15 x (45)m

30.5734	26.9293	28.3133	24.1636	22.9323	20.1272	19.4636	20.5304	21.0828	24.1535	26.4740	30.1417	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
										Total per year (kWh/year) = Sum(64)m =		2212.9335	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	84.5557	74.8537	79.5459	69.8059	67.6179	60.8584	59.9291	62.2937	62.9767	70.3250	74.9273	83.5988	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.7487	15.7643	12.8204	9.7058	7.2552	6.1252	6.6185	8.6029	11.5468	14.6613	17.1120	18.2420	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	225.4877	227.8276	221.9312	209.3786	193.5331	178.6406	168.6914	166.3516	172.2479	184.8006	200.6461	215.5386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	(71)
Water heating gains (Table 5)	113.6501	111.3894	106.9165	96.9526	90.8842	84.5256	80.5498	83.7281	87.4676	94.5228	104.0656	112.3640	(72)
Total internal gains	438.6972	436.7919	423.4788	397.8477	373.4832	351.1020	337.6704	340.4934	353.0731	375.7954	403.6344	427.9553	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(77)

Solar gains	95.2051	173.0844	247.4999	322.5774	357.6553	345.0938	336.8383	300.1802	265.5901	190.1488	117.1921	83.3220	(83)
Total gains	533.9023	609.8763	670.9786	720.4250	731.1385	696.1958	674.5087	640.6735	618.6632	565.9442	520.8265	511.2773	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	119.2167	119.2167	120.4016	124.1019	124.7408	127.3637	128.7170	128.7170	126.0386	122.8434	121.6103	122.2237	
alpha	8.9478	8.9478	9.0268	9.2735	9.3161	9.4909	9.5811	9.5811	9.4026	9.1896	9.1074	9.1482	
util living area	0.7526	0.6539	0.5462	0.4206	0.3242	0.2525	0.2017	0.2158	0.3019	0.4664	0.6480	0.7727	(86)
MIT	20.9712	20.9903	20.9979	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9996	20.9929	20.9672	(87)
Th 2	20.5504	20.5504	20.5547	20.5675	20.5696	20.5781	20.5824	20.5824	20.5738	20.5632	20.5589	20.5611	(88)
util rest of house	0.7357	0.6373	0.5306	0.4067	0.3107	0.2389	0.1879	0.2013	0.2862	0.4484	0.6291	0.7564	(89)
MIT 2	20.5201	20.5405	20.5526	20.5673	20.5696	20.5781	20.5824	20.5824	20.5738	20.5629	20.5519	20.5263	(90)
Living area fraction										fLA = Living area / (4) =		0.5577	(91)
MIT	20.7716	20.7914	20.8010	20.8085	20.8096	20.8134	20.8153	20.8153	20.8115	20.8064	20.7978	20.7722	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7716	20.7914	20.8010	20.8085	20.8096	20.8134	20.8153	20.8153	20.8115	20.8064	20.7978	20.7722	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7441	0.6462	0.5392	0.4144	0.3182	0.2465	0.1956	0.2094	0.2950	0.4585	0.6394	0.7643	(94)
Useful gains	397.2723	394.1170	361.8210	298.5746	232.6729	171.6165	131.9370	134.1674	182.4879	259.4584	332.9973	390.7730	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	406.3003	397.1421	362.4645	298.6242	232.6766	171.6167	131.9370	134.1674	182.4893	259.5673	335.1804	401.0157	(97)
Space heating kWh	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205	(98a)
Space heating requirement - total per year (kWh/year)												18.5404	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												18.5404	
Space heating per m2											(98c) / (4) =	0.3601	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													

	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	8.9614	8.0942	8.9614	8.6723	8.9614	8.6723	8.9614	8.9614	8.6723	8.9614	8.6723	8.9614 (231)
Lighting	15.5353	12.4630	11.2216	8.2214	6.3505	5.1884	5.7931	7.5301	9.7808	12.8330	14.4948	15.9671 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-11.1496	-18.8721	-32.0603	-42.3899	-49.6609	-46.9012	-46.5595	-40.9992	-33.1527	-23.1943	-13.2464	-9.5840 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.0858	-5.3278	-12.5367	-22.4603	-31.0947	-30.7742	-30.8282	-23.8754	-16.0865	-7.9699	-3.0116	-1.6564 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	18.5404 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2212.9335 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	105.5134 (230a)
Total electricity for the above, kWh/year	105.5134 (231)
Electricity for lighting (calculated in Appendix L)	125.3792 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-555.4776 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1906.8888 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	18.5404	25.1600	4.6648	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	25.1600	556.7741	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	105.5134	25.1600	26.5472	(249)
Energy for lighting	125.3792	25.1600	31.5454	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.7700	25.1600	-92.5309	
PV Unit electricity exported	-187.7076	5.8100	-10.9058	
Total			-103.4367	(252)
Total energy cost			516.0946	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	18.5404	0.1612	2.9893	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2212.9335	0.1413	312.5953	(264)
Space and water heating			315.5847	(265)
Pumps, fans and electric keep-hot	105.5134	0.1387	14.6360	(267)
Energy for lighting	125.3792	0.1443	18.0961	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.7700	0.1319	-48.5087	
PV Unit electricity exported	-187.7076	0.1230	-23.0860	
Total			-71.5947	(269)
Total CO2, kg/year			276.7220	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	18.5404	1.5966	29.6024	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	1.5223	3368.8373	(278)
Space and water heating			3398.4396	(279)

Pumps, fans and electric keep-hot	105.5134	1.5128	159.6207 (281)
Energy for lighting	125.3792	1.5338	192.3107 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-367.7700	1.4873	-546.9961
PV Unit electricity exported	-187.7076	0.4514	-84.7250
Total			-631.7212 (283)
Total Primary energy kWh/year			3118.6499 (286)

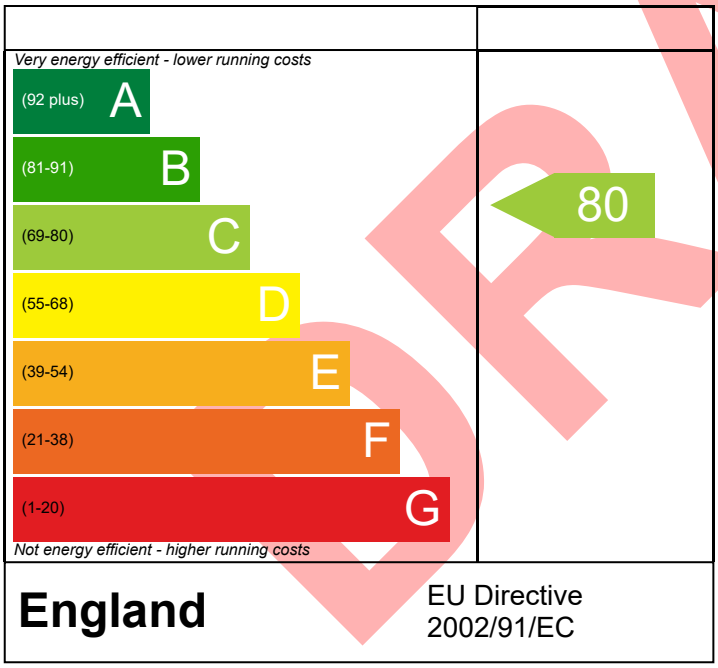
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	51.48 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

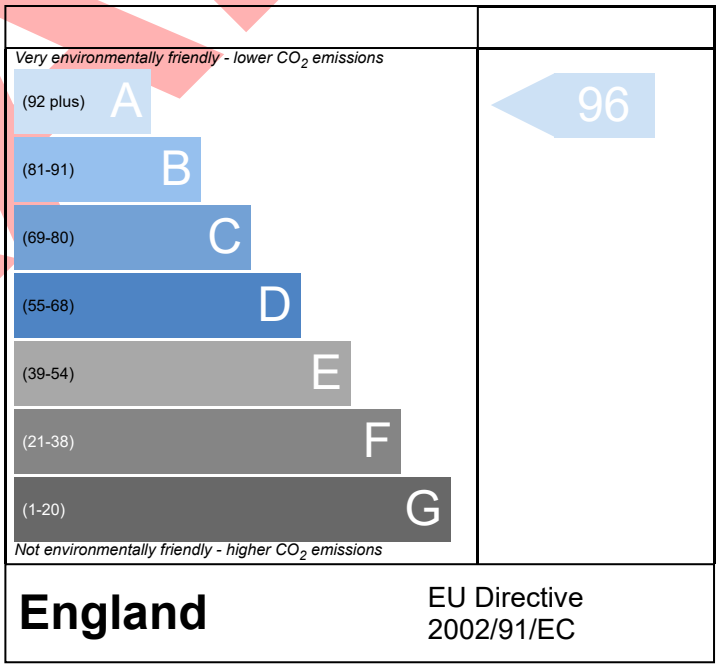
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:45

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	66 m^2
Site Reference	Unit 77 L04_Copy	Plot Reference	Unit 77 L04_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*12.09 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	5.9 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*65.26 kWh$_{PE}$/m^2*	
Dwelling primary energy	65.22 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*25.4 kWh/m^2*	
Dwelling fabric energy efficiency	26.2 kWh/m^2	FAIL

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	21.88	0.14 **(!)**
Party wall: Party Wall (1)	30.24	0 **(!)**
Party wall: Party Wall (2)	14.18	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	7.88	North East	0.83	1.3
N, Opening Type 1	3.59	North	0.83	1.3
NW, Opening Type 1	7.88	North West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.85 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 77 L04_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 77 L04_Copy	**Prop Type Ref**	Unit 77 L04
Property			

SAP Rating	77 C	**DER**	5.90	**TER**	12.09
Environmental	95 A	**% DER < TER**			51.20
CO_2 Emissions (t/year)	0.39	**DFEE**	26.20	**TFEE**	25.40
Compliance Check	See BREL	**% DFEE < TFEE**			-3.16
% DPER < TPER	0.06	**DPER**	65.22	**TPER**	65.26

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.6000 (1b)	x	2.4000 (2b)	=	157.4400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	157.4400	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.3500	1.2357	23.9116			(27)
External Wall 1	41.2300	19.3500	21.8800	0.1400	3.0632	14.0000	306.3200	(29a)
Total net area of external elements Aum(A, m2)			41.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.9748			(33)
Party Wall 1			30.2400	0.0000	0.0000	20.0000	604.8000	(32)
Wall to corridor			14.1800	0.0000	0.0000	20.0000	283.6000	(32)
Party Floor 1			65.6000			80.0000	5248.0000	(32d)
Party Ceiling 1			65.6000			80.0000	5248.0000	(32b)
Internal Wall 1			114.4800			9.0000	1030.3200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12721.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	193.9183 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240

E4 Jamb	23.2000	0.0500	1.1600	
E7 Party floor between dwellings (in blocks of flats)	15.2700	0.0700	1.0689	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.4500	0.0000	0.0000	
E16 Corner (normal)	5.4000	0.0900	0.4860	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.4629 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 30.4377 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.7197	15.5541	15.3885	14.5604	14.3948	13.5668	13.5668	13.4012	13.8980	14.3948	14.7261	15.0573	(38)
Heat transfer coeff	46.1574	45.9918	45.8262	44.9981	44.8325	44.0045	44.0045	43.8389	44.3357	44.8325	45.1637	45.4950	(39)
Average = Sum(39)m / 12 =												44.9567	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7036	0.7011	0.6986	0.6859	0.6834	0.6708	0.6708	0.6683	0.6758	0.6834	0.6885	0.6935	(40)
HLP (average)												0.6853	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1348 (42)
Hot water usage for mixer showers

82.5173	81.2772	79.4702	76.0128	73.4613	70.6159	68.9985	70.7919	72.7577	75.8128	79.3445	82.2011	(42a)

Hot water usage for baths

25.9306	25.5455	25.0032	24.0033	23.2545	22.4243	21.9759	22.5144	23.1007	23.9891	25.0096	25.8429	(42b)

Hot water usage for other uses

36.4921	35.1651	33.8381	32.5112	31.1842	29.8572	29.8572	31.1842	32.5112	33.8381	35.1651	36.4921	(42c)

Average daily hot water use (litres/day) 133.2946 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.9400	141.9879	138.3115	132.5272	127.9000	122.8974	120.8316	124.4905	128.3696	133.6401	139.5193	144.5362	(44)
Energy conte	229.5496	202.1888	212.5797	181.4231	172.1780	151.1167	146.1353	154.1452	158.2926	181.3483	198.7708	226.3088	(45)
Energy content (annual)										Total = Sum(45)m =		2214.0368	

Distribution loss (46)m = 0.15 x (45)m

34.4324	30.3283	31.8870	27.2135	25.8267	22.6675	21.9203	23.1218	23.7439	27.2023	29.8156	33.9463	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)

Total per year (kWh/year) = Sum(64)m = 2461.0688 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

93.1099	82.3881	87.4674	76.5664	74.0338	66.4895	65.3746	68.0379	68.8755	77.0830	82.3345	92.0323	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.5047	19.1002	15.5334	11.7598	8.7906	7.4214	8.0190	10.4234	13.9903	17.7639	20.7331	22.1023	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	278.8333	281.7267	274.4354	258.9131	239.3189	220.9031	208.6002	205.7068	212.9981	228.5205	248.1147	266.5304	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(70)
Losses e.g. evaporation (negative values) (Table 5)	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	(71)
Water heating gains (Table 5)	125.1477	122.6013	117.5637	106.3422	99.5078	92.3465	87.8691	91.4488	95.6604	103.6061	114.3535	123.6993	(72)
Total internal gains	518.1243	516.0669	500.1711	469.6536	440.2559	413.3096	397.1270	400.2177	415.2875	442.5292	475.8399	504.9707	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5900	10.6334	0.6300	0.8270	0.7700	13.7831	(74)
Northeast	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(75)
Northwest	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(81)

Solar gains 77.9864	157.0279	280.2162	458.5828	616.6334	657.8250	615.1898	490.0648	340.7231	191.0654	97.7876	63.9219	(83)
Total gains 596.1107	673.0949	780.3873	928.2365	1056.8893	1071.1345	1012.3168	890.2825	756.0106	633.5945	573.6275	568.8927	(84)

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7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
tau	76.5559	76.8316	77.1093	78.5282	78.8183	80.3014	80.3014	80.6047	79.7015	78.8183	78.2402	77.6706	
alpha	6.1037	6.1221	6.1406	6.2352	6.2546	6.3534	6.3534	6.3736	6.3134	6.2546	6.2160	6.1780	
util living area	0.9437	0.8971	0.7825	0.5777	0.3938	0.2629	0.1913	0.2265	0.4038	0.7039	0.8971	0.9531	(86)
MIT	20.5409	20.6986	20.8811	20.9817	20.9983	20.9999	21.0000	21.0000	20.9987	20.9551	20.7496	20.5092	(87)
Th 2	20.3376	20.3399	20.3421	20.3533	20.3555	20.3667	20.3667	20.3689	20.3622	20.3555	20.3510	20.3466	(88)
util rest of house	0.9339	0.8815	0.7577	0.5488	0.3667	0.2369	0.1637	0.1954	0.3668	0.6677	0.8790	0.9447	(89)
MIT 2	19.8185	20.0094	20.2201	20.3364	20.3542	20.3666	20.3667	20.3689	20.3613	20.3148	20.0834	19.7875	(90)
Living area fraction										fLA = Living area / (4) =		0.4663	(91)
MIT	20.1554	20.3308	20.5284	20.6373	20.6546	20.6619	20.6620	20.6632	20.6585	20.6134	20.3941	20.1241	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1554	20.3308	20.5284	20.6373	20.6546	20.6619	20.6620	20.6632	20.6585	20.6134	20.3941	20.1241	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9309	0.8813	0.7649	0.5616	0.3793	0.2490	0.1766	0.2099	0.3841	0.6825	0.8803	0.9414	(94)
Useful gains	554.9067	593.1911	596.9001	521.2762	400.8703	266.7233	178.7442	186.8865	290.3468	432.4035	504.9500	535.5811	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	731.8424	709.6904	642.8668	528.1577	401.4553	266.7525	178.7466	186.8936	290.7766	448.9253	600.4104	724.4643	(97)
Space heating kWh	131.6402	78.2875	34.1992	4.9547	0.4352	0.0000	0.0000	0.0000	0.0000	12.2922	68.7315	140.5291	(98a)
Space heating requirement - total per year (kWh/year)												471.0696	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	131.6402	78.2875	34.1992	4.9547	0.4352	0.0000	0.0000	0.0000	0.0000	12.2922	68.7315	140.5291	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												471.0696	
Space heating per m2											(98c) / (4) =	7.1809	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	131.6402	78.2875	34.1992	4.9547	0.4352	0.0000	0.0000	0.0000	0.0000	12.2922	68.7315	140.5291	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	131.6402	78.2875	34.1992	4.9547	0.4352	0.0000	0.0000	0.0000	0.0000	12.2922	68.7315	140.5291	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	12.1045	10.9331	12.1045	11.7141	12.1045	11.7141	12.1045	12.1045	11.7141	12.1045	11.7141	12.1045	(231)
Lighting	18.8229	15.1004	13.5963	9.9612	7.6943	6.2863	7.0190	9.1236	11.8506	15.5487	17.5622	19.3460	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.8151	-25.1332	-40.5864	-50.8024	-59.6183	-57.3843	-56.4723	-50.9617	-41.6122	-30.4646	-18.2004	-13.3279	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.9195	-6.9836	-16.0113	-27.2032	-38.1758	-39.2360	-38.6794	-31.3088	-21.3818	-11.1448	-4.1988	-2.2253	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	471.0696	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2461.0688	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	142.5210	(230a)
Total electricity for the above, kWh/year	142.5210	(231)
Electricity for lighting (calculated in Appendix L)	151.9116	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-699.8470	(233)
Wind generation	0.0000	(234)

Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2526.7240	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	471.0696	16.4900	77.6794	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	16.4900	405.8302	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	142.5210	16.4900	23.5017	(249)
Energy for lighting	151.9116	16.4900	25.0502	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.3787	16.4900	-75.9165	
PV Unit electricity exported	-239.4682	5.5900	-13.3863	
Total			-89.3027	(252)
Total energy cost			442.7588	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.4412	(257)
SAP value	76.6387	
SAP rating (Section 12)	77	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	471.0696	0.1591	74.9382	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2461.0688	0.1413	347.7259	(264)
Space and water heating			422.6642	(265)
Pumps, fans and electric keep-hot	142.5210	0.1387	19.7694	(267)
Energy for lighting	151.9116	0.1443	21.9255	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.3787	0.1324	-60.9461	
PV Unit electricity exported	-239.4682	0.1230	-29.4551	
Total			-90.4011	(269)
Total CO2, kg/year			373.9580	(272)
CO2 emissions per m2			5.7000	(273)
EI value			95.4692	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.6000 (1b)	x	2.4000 (2b)	=	157.4400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	157.4400	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.3500	1.2357	23.9116			(27)
External Wall 1	41.2300	19.3500	21.8800	0.1400	3.0632	14.0000	306.3200	(29a)
Total net area of external elements Aum(A, m2)			41.2300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.9748			(33)
Party Wall 1			30.2400	0.0000	0.0000	20.0000	604.8000	(32)
Wall to corridor			14.1800	0.0000	0.0000	20.0000	283.6000	(32)
Party Floor 1			65.6000			80.0000	5248.0000	(32d)
Party Ceiling 1			65.6000			80.0000	5248.0000	(32b)
Internal Wall 1			114.4800			9.0000	1030.3200	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12721.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 193.9183 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	15.2700	0.0700	1.0689
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.4500	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.4629 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 30.4377 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.8853	15.8853	15.5541	14.5604	14.3948	13.7324	13.4012	13.4012	14.0636	14.8917	15.2229	15.0573	(38)
Heat transfer coeff	46.3230	46.3230	45.9918	44.9981	44.8325	44.1701	43.8389	43.8389	44.5013	45.3294	45.6606	45.4950	(39)

Average = Sum(39)m / 12 = 45.1085

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7061	0.7061	0.7011	0.6859	0.6834	0.6733	0.6683	0.6683	0.6784	0.6910	0.6960	0.6935	(40)
HLP (average)												0.6876	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1348 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	82.5173	81.2772	79.4702	76.0128	73.4613	70.6159	68.9985	70.7919	72.7577	75.8128	79.3445	82.2011	(42a)
Hot water usage for baths	25.9306	25.5455	25.0032	24.0033	23.2545	22.4243	21.9759	22.5144	23.1007	23.9891	25.0096	25.8429	(42b)
Hot water usage for other uses	36.4921	35.1651	33.8381	32.5112	31.1842	29.8572	29.8572	31.1842	32.5112	33.8381	35.1651	36.4921	(42c)

Average daily hot water use (litres/day) 133.2946 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.9400	141.9879	138.3115	132.5272	127.9000	122.8974	120.8316	124.4905	128.3696	133.6401	139.5193	144.5362	(44)
Energy conte	229.5496	202.1888	212.5797	181.4231	172.1780	151.1167	146.1353	154.1452	158.2926	181.3483	198.7708	226.3088	(45)

Energy content (annual) Total = Sum(45)m = 2214.0368
Distribution loss (46)m = 0.15 x (45)m

	34.4324	30.3283	31.8870	27.2135	25.8267	22.6675	21.9203	23.1218	23.7439	27.2023	29.8156	33.9463	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)

Total per year (kWh/year) = Sum(64)m = 2461.0688 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

	93.1099	82.3881	87.4674	76.5664	74.0338	66.4895	65.3746	68.0379	68.8755	77.0830	82.3345	92.0323	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	21.5047	19.1002	15.5334	11.7598	8.7906	7.4214	8.0190	10.4234	13.9903	17.7639	20.7331	22.1023	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	278.8333	281.7267	274.4354	258.9131	239.3189	220.9031	208.6002	205.7068	212.9981	228.5205	248.1147	266.5304	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	(71)

Water heating gains (Table 5)

	125.1477	122.6013	117.5637	106.3422	99.5078	92.3465	87.8691	91.4488	95.6604	103.6061	114.3535	123.6993	(72)

Total internal gains

	518.1243	516.0669	500.1711	469.6536	440.2559	413.3096	397.1270	400.2177	415.2875	442.5292	475.8399	504.9707	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5900	9.5462	0.6300	0.8270	0.7700	12.3738	(74)
Northeast	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(75)
Northwest	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(81)

Solar gains	69.4528	148.6778	276.6041	477.3240	638.3689	663.6861	627.6104	484.0300	333.4428	179.5688	89.3871	58.2939	(83)
Total gains	587.5771	664.7447	776.7752	946.9776	1078.6248	1076.9957	1024.7374	884.2477	748.7303	622.0980	565.2270	563.2647	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.2822	76.2822	76.8316	78.5282	78.8183	80.0003	80.6047	80.6047	79.4049	77.9544	77.3889	77.6706	
alpha	6.0855	6.0855	6.1221	6.2352	6.2546	6.3334	6.3736	6.3736	6.2937	6.1970	6.1593	6.1780	
util living area	0.9523	0.9151	0.8170	0.6098	0.4269	0.3197	0.2609	0.3073	0.4846	0.7655	0.9164	0.9604	(86)
MIT	20.4877	20.6359	20.8375	20.9735	20.9971	20.9996	20.9999	20.9998	20.9955	20.9203	20.6918	20.4562	(87)
Th 2	20.3354	20.3354	20.3399	20.3533	20.3555	20.3645	20.3689	20.3689	20.3600	20.3488	20.3443	20.3466	(88)
util rest of house	0.9439	0.9018	0.7950	0.5824	0.4005	0.2937	0.2339	0.2760	0.4477	0.7329	0.9011	0.9533	(89)
MIT 2	19.7510	19.9303	20.1689	20.3280	20.3531	20.3642	20.3689	20.3688	20.3565	20.2729	20.0092	19.7217	(90)
Living area fraction									fLA = Living area / (4) =			0.4663	(91)
MIT	20.0946	20.2593	20.4807	20.6290	20.6534	20.6605	20.6631	20.6630	20.6545	20.5748	20.3275	20.0642	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0946	20.2593	20.4807	20.6290	20.6534	20.6605	20.6631	20.6630	20.6545	20.5748	20.3275	20.0642	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9404	0.9002	0.7998	0.5942	0.4127	0.3059	0.2465	0.2906	0.4648	0.7445	0.9007	0.9498	(94)
Useful gains	552.5820	598.3955	621.2894	562.6696	445.1856	329.4043	252.6245	256.9595	347.9863	463.1695	509.0750	534.9752	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	750.1804	739.2834	684.3902	572.7824	446.2351	329.5308	252.6499	257.0288	349.5347	492.9470	626.8071	744.4884	(97)
Space heating kWh	147.0132	94.6766	46.9470	7.2812	0.7808	0.0000	0.0000	0.0000	0.0000	22.1544	84.7671	155.8778	(98a)
Space heating requirement - total per year (kWh/year)												559.4982	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	147.0132	94.6766	46.9470	7.2812	0.7808	0.0000	0.0000	0.0000	0.0000	22.1544	84.7671	155.8778	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												559.4982	
Space heating per m2											(98c) / (4) =	8.5289	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	147.0132	94.6766	46.9470	7.2812	0.7808	0.0000	0.0000	0.0000	0.0000	22.1544	84.7671	155.8778	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	147.0132	94.6766	46.9470	7.2812	0.7808	0.0000	0.0000	0.0000	0.0000	22.1544	84.7671	155.8778	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
Efficiency of water heater												100.0000	(216)

(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	12.1045	10.9331	12.1045	11.7141	12.1045	11.7141	12.1045	12.1045	11.7141	12.1045	11.7141	12.1045	(231)
Lighting	18.8229	15.1004	13.5963	9.9612	7.6943	6.2863	7.0190	9.1236	11.8506	15.5487	17.5622	19.3460	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.3335	-24.2496	-40.7429	-53.0154	-61.7317	-58.2186	-57.7804	-50.9772	-41.3377	-29.2830	-16.9564	-12.3241	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4576	-6.4518	-15.8354	-29.2573	-40.7194	-40.3248	-40.3981	-31.3264	-21.1298	-10.2536	-3.6695	-1.9361	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	559.4982	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2461.0688	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	142.5210	(230a)
Total electricity for the above, kWh/year	142.5210	(231)
Electricity for lighting (calculated in Appendix L)	151.9116	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-704.7104	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2610.2892	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	559.4982	25.1600	140.7697	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	25.1600	619.2049	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	142.5210	25.1600	35.8583	(249)
Energy for lighting	151.9116	25.1600	38.2210	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.9505	25.1600	-115.9752	
PV Unit electricity exported	-243.7598	5.8100	-14.1624	
Total			-130.1376	(252)
Total energy cost			703.9163	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	559.4982	0.1585	88.6595	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2461.0688	0.1413	347.7259	(264)
Space and water heating			436.3854	(265)
Pumps, fans and electric keep-hot	142.5210	0.1387	19.7694	(267)
Energy for lighting	151.9116	0.1443	21.9255	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.9505	0.1321	-60.8840	
PV Unit electricity exported	-243.7598	0.1225	-29.8531	
Total			-90.7371	(269)
Total CO2, kg/year			387.3433	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	559.4982	1.5865	887.6647	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	1.5225	3746.8812	(278)
Space and water heating			4634.5458	(279)
Pumps, fans and electric keep-hot	142.5210	1.5128	215.6057	(281)
Energy for lighting	151.9116	1.5338	233.0071	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.9505	1.4880	-685.9054	
PV Unit electricity exported	-243.7598	0.4495	-109.5580	
Total			-795.4634	(283)
Total Primary energy kWh/year			4287.6952	(286)

SAP 10 EPC IMPROVEMENTS

Unit 77 L04_Copy

Current energy efficiency rating: C 77
Current environmental impact rating: A 95

N Solar water heating	Not applicable
U Solar photovoltaic panels	Not applicable
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 77
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£834	£834	£0
Space heating	£177	£177	£0
Water heating	£619	£619	£0
Lighting	£38	£38	£0
Generated (PV)	-£130	-£130	£0
Total cost of fuels	£704	£704	£0
Total cost of uses	£704	£704	£0
Delivered energy	40 kWh/m²	40 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	65 kWh/m²	65 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.6000 (1b)	x	2.4000 (2b)	=	157.4400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	157.4400	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.3500	1.2357	23.9116			(27)
External Wall 1	41.2300	19.3500	21.8800	0.1400	3.0632	14.0000	306.3200	(29a)
Total net area of external elements Aum(A, m2)			41.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.9748			(33)
Party Wall 1			30.2400	0.0000	0.0000	20.0000	604.8000	(32)
Wall to corridor			14.1800	0.0000	0.0000	20.0000	283.6000	(32)
Party Floor 1			65.6000			80.0000	5248.0000	(32d)
Party Ceiling 1			65.6000			80.0000	5248.0000	(32b)
Internal Wall 1			114.4800			9.0000	1030.3200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12721.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		193.9183 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	15.2700	0.0700	1.0689
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.4500	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.4629 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	30.4377 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.7197	15.5541	15.3885	14.5604	14.3948	13.5668	13.5668	13.4012	13.8980	14.3948	14.7261	15.0573	(38)
Heat transfer coeff	46.1574	45.9918	45.8262	44.9981	44.8325	44.0045	44.0045	43.8389	44.3357	44.8325	45.1637	45.4950	(39)
Average = Sum(39)m / 12 =												44.9567	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7036	0.7011	0.6986	0.6859	0.6834	0.6708	0.6708	0.6683	0.6758	0.6834	0.6885	0.6935	(40)
HLP (average)												0.6853	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.1348 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
82.5173	81.2772	79.4702	76.0128	73.4613	70.6159	68.9985	70.7919	72.7577	75.8128	79.3445	82.2011	(42a)

Hot water usage for baths

25.9306	25.5455	25.0032	24.0033	23.2545	22.4243	21.9759	22.5144	23.1007	23.9891	25.0096	25.8429	(42b)

Hot water usage for other uses

36.4921	35.1651	33.8381	32.5112	31.1842	29.8572	29.8572	31.1842	32.5112	33.8381	35.1651	36.4921	(42c)

Average daily hot water use (litres/day)		133.2946 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.9400	141.9879	138.3115	132.5272	127.9000	122.8974	120.8316	124.4905	128.3696	133.6401	139.5193	144.5362	(44)
Energy conte	229.5496	202.1888	212.5797	181.4231	172.1780	151.1167	146.1353	154.1452	158.2926	181.3483	198.7708	226.3088	(45)
Energy content (annual)										Total = Sum(45)m =		2214.0368	
Distribution loss (46)m = 0.15 x (45)m	34.4324	30.3283	31.8870	27.2135	25.8267	22.6675	21.9203	23.1218	23.7439	27.2023	29.8156	33.9463	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
									Total per year (kWh/year) = Sum(64)m =		2461.0688	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000 (64a)

Heat gains from water heating, kWh/month

93.1099	82.3881	87.4674	76.5664	74.0338	66.4895	65.3746	68.0379	68.8755	77.0830	82.3345	92.0323	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.5047	19.1002	15.5334	11.7598	8.7906	7.4214	8.0190	10.4234	13.9903	17.7639	20.7331	22.1023	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	278.8333	281.7267	274.4354	258.9131	239.3189	220.9031	208.6002	205.7068	212.9981	228.5205	248.1147	266.5304	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(70)
Losses e.g. evaporation (negative values) (Table 5)	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	(71)
Water heating gains (Table 5)	125.1477	122.6013	117.5637	106.3422	99.5078	92.3465	87.8691	91.4488	95.6604	103.6061	114.3535	123.6993	(72)

Total internal gains

	518.1243	516.0669	500.1711	469.6536	440.2559	413.3096	397.1270	400.2177	415.2875	442.5292	475.8399	504.9707 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5900	10.6334	0.6300	0.8270	0.7700	13.7831	(74)
Northeast	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(75)
Northwest	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(81)

Solar gains	77.9864	157.0279	280.2162	458.5828	616.6334	657.8250	615.1898	490.0648	340.7231	191.0654	97.7876	63.9219	(83)
Total gains	596.1107	673.0949	780.3873	928.2365	1056.8893	1071.1345	1012.3168	890.2825	756.0106	633.5945	573.6275	568.8927	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.5559	76.8316	77.1093	78.5282	78.8183	80.3014	80.3014	80.6047	79.7015	78.8183	78.2402	77.6706	
alpha	6.1037	6.1221	6.1406	6.2352	6.2546	6.3534	6.3534	6.3736	6.3134	6.2546	6.2160	6.1780	
util living area	0.9437	0.8971	0.7825	0.5777	0.3938	0.2629	0.1913	0.2265	0.4038	0.7039	0.8971	0.9531	(86)
MIT	20.5409	20.6986	20.8811	20.9817	20.9983	20.9999	21.0000	21.0000	20.9987	20.9551	20.7496	20.5092	(87)
Th 2	20.3376	20.3399	20.3421	20.3533	20.3555	20.3667	20.3667	20.3689	20.3622	20.3555	20.3510	20.3466	(88)
util rest of house	0.9339	0.8815	0.7577	0.5488	0.3667	0.2369	0.1637	0.1954	0.3668	0.6677	0.8790	0.9447	(89)
MIT 2	19.8185	20.0094	20.2201	20.3364	20.3542	20.3666	20.3667	20.3689	20.3613	20.3148	20.0834	19.7875	(90)
Living area fraction									fLA = Living area / (4) =			0.4663	(91)
MIT	20.1554	20.3308	20.5284	20.6373	20.6546	20.6619	20.6620	20.6632	20.6585	20.6134	20.3941	20.1241	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1554	20.3308	20.5284	20.6373	20.6546	20.6619	20.6620	20.6632	20.6585	20.6134	20.3941	20.1241	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9309	0.8813	0.7649	0.5616	0.3793	0.2490	0.1766	0.2099	0.3841	0.6825	0.8803	0.9414	(94)
Useful gains	554.9067	593.1911	596.9001	521.2762	400.8703	266.7233	178.7442	186.8865	290.3468	432.4035	504.9500	535.5811	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	731.8424	709.6904	642.8668	528.1577	401.4553	266.7525	178.7466	186.8936	290.7766	448.9253	600.4104	724.4643	(97)
Space heating kWh	131.6402	78.2875	34.1992	4.9547	0.4352	0.0000	0.0000	0.0000	0.0000	12.2922	68.7315	140.5291	(98a)
Space heating requirement - total per year (kWh/year)												471.0696	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	131.6402	78.2875	34.1992	4.9547	0.4352	0.0000	0.0000	0.0000	0.0000	12.2922	68.7315	140.5291	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												471.0696	
Space heating per m2											(98c) / (4) =	7.1809	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	131.6402	78.2875	34.1992	4.9547	0.4352	0.0000	0.0000	0.0000	0.0000	12.2922	68.7315	140.5291	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	131.6402	78.2875	34.1992	4.9547	0.4352	0.0000	0.0000	0.0000	0.0000	12.2922	68.7315	140.5291	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	12.1045	10.9331	12.1045	11.7141	12.1045	11.7141	12.1045	12.1045	11.7141	12.1045	11.7141	12.1045	(231)
Lighting	18.8229	15.1004	13.5963	9.9612	7.6943	6.2863	7.0190	9.1236	11.8506	15.5487	17.5622	19.3460	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.8151	-25.1332	-40.5864	-50.8024	-59.6183	-57.3843	-56.4723	-50.9617	-41.6122	-30.4646	-18.2004	-13.3279	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													

(233b)m	-2.9195	-6.9836	-16.0113	-27.2032	-38.1758	-39.2360	-38.6794	-31.3088	-21.3818	-11.1448	-4.1988	-2.2253	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	471.0696	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2461.0688	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	142.5210	(230a)
Total electricity for the above, kWh/year	142.5210	(231)
Electricity for lighting (calculated in Appendix L)	151.9116	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-699.8470	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2526.7240	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	471.0696	16.4900	77.6794	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	16.4900	405.8302	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	142.5210	16.4900	23.5017	(249)
Energy for lighting	151.9116	16.4900	25.0502	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.3787	16.4900	-75.9165	
PV Unit electricity exported	-239.4682	5.5900	-13.3863	
Total			-89.3027	(252)
Total energy cost			442.7588	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.4412	(257)
SAP value		76.6387	
SAP rating (Section 12)		77	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	471.0696	0.1591	74.9382	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2461.0688	0.1413	347.7259	(264)
Space and water heating			422.6642	(265)
Pumps, fans and electric keep-hot	142.5210	0.1387	19.7694	(267)
Energy for lighting	151.9116	0.1443	21.9255	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.3787	0.1324	-60.9461	
PV Unit electricity exported	-239.4682	0.1230	-29.4551	
Total			-90.4011	(269)
Total CO2, kg/year			373.9580	(272)
CO2 emissions per m2			5.7000	(273)
EI value			95.4692	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		65.6000 (1b)	x	2.4000 (2b)	=	157.4400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.6000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	157.4400	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.3500	1.2357	23.9116			(27)
External Wall 1	41.2300	19.3500	21.8800	0.1400	3.0632	14.0000	306.3200	(29a)
Total net area of external elements Aum(A, m2)			41.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.9748			(33)
Party Wall 1			30.2400	0.0000	0.0000	20.0000	604.8000	(32)
Wall to corridor			14.1800	0.0000	0.0000	20.0000	283.6000	(32)
Party Floor 1			65.6000			80.0000	5248.0000	(32d)
Party Ceiling 1			65.6000			80.0000	5248.0000	(32b)
Internal Wall 1			114.4800			9.0000	1030.3200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12721.0400	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	193.9183	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	15.2700	0.0700	1.0689
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.4500	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	3.4629	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	30.4377	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.8853	15.8853	15.5541	14.5604	14.3948	13.7324	13.4012	13.4012	14.0636	14.8917	15.2229	15.0573	(38)
Heat transfer coeff	46.3230	46.3230	45.9918	44.9981	44.8325	44.1701	43.8389	43.8389	44.5013	45.3294	45.6606	45.4950	(39)
Average = Sum(39)m / 12 =												45.1085	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7061	0.7061	0.7011	0.6859	0.6834	0.6733	0.6683	0.6683	0.6784	0.6910	0.6960	0.6935	(40)
HLP (average)												0.6876	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1348	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
82.5173	81.2772	79.4702	76.0128	73.4613	70.6159	68.9985	70.7919	72.7577	75.8128	79.3445	82.2011	(42a)

Hot water usage for baths

25.9306	25.5455	25.0032	24.0033	23.2545	22.4243	21.9759	22.5144	23.1007	23.9891	25.0096	25.8429	(42b)

Hot water usage for other uses

36.4921	35.1651	33.8381	32.5112	31.1842	29.8572	29.8572	31.1842	32.5112	33.8381	35.1651	36.4921	(42c)

Average daily hot water use (litres/day)	133.2946 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.9400	141.9879	138.3115	132.5272	127.9000	122.8974	120.8316	124.4905	128.3696	133.6401	139.5193	144.5362	(44)
Energy conte	229.5496	202.1888	212.5797	181.4231	172.1780	151.1167	146.1353	154.1452	158.2926	181.3483	198.7708	226.3088	(45)
Energy content (annual)										Total = Sum(45)m =		2214.0368	

Distribution loss (46)m = 0.15 x (45)m

34.4324	30.3283	31.8870	27.2135	25.8267	22.6675	21.9203	23.1218	23.7439	27.2023	29.8156	33.9463	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)

Total per year (kWh/year) = Sum(64)m = 2461.0688 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

93.1099	82.3881	87.4674	76.5664	74.0338	66.4895	65.3746	68.0379	68.8755	77.0830	82.3345	92.0323	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

21.5047	19.1002	15.5334	11.7598	8.7906	7.4214	8.0190	10.4234	13.9903	17.7639	20.7331	22.1023	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

278.8333	281.7267	274.4354	258.9131	239.3189	220.9031	208.6002	205.7068	212.9981	228.5205	248.1147	266.5304	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	(71)

Water heating gains (Table 5)

125.1477	122.6013	117.5637	106.3422	99.5078	92.3465	87.8691	91.4488	95.6604	103.6061	114.3535	123.6993	(72)

Total internal gains

518.1243	516.0669	500.1711	469.6536	440.2559	413.3096	397.1270	400.2177	415.2875	442.5292	475.8399	504.9707	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5900	9.5462	0.6300	0.8270	0.7700	12.3738	(74)
Northeast	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(75)
Northwest	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(81)

Solar gains 69.4528	148.6778	276.6041	477.3240	638.3689	663.6861	627.6104	484.0300	333.4428	179.5688	89.3871	58.2939	(83)
Total gains 587.5771	664.7447	776.7752	946.9776	1078.6248	1076.9957	1024.7374	884.2477	748.7303	622.0980	565.2270	563.2647	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.2822	76.2822	76.8316	78.5282	78.8183	80.0003	80.6047	80.6047	79.4049	77.9544	77.3889	77.6706	
alpha	6.0855	6.0855	6.1221	6.2352	6.2546	6.3334	6.3736	6.3736	6.2937	6.1970	6.1593	6.1780	
util living area	0.9523	0.9151	0.8170	0.6098	0.4269	0.3197	0.2609	0.3073	0.4846	0.7655	0.9164	0.9604	(86)
MIT	20.4877	20.6359	20.8375	20.9735	20.9971	20.9996	20.9999	20.9998	20.9955	20.9203	20.6918	20.4562	(87)
Th 2	20.3354	20.3354	20.3399	20.3533	20.3555	20.3645	20.3689	20.3689	20.3600	20.3488	20.3443	20.3466	(88)
util rest of house	0.9439	0.9018	0.7950	0.5824	0.4005	0.2937	0.2339	0.2760	0.4477	0.7329	0.9011	0.9533	(89)
MIT 2	19.7510	19.9303	20.1689	20.3280	20.3531	20.3642	20.3689	20.3688	20.3565	20.2729	20.0092	19.7217	(90)
Living area fraction									fLA = Living area / (4) =			0.4663	(91)
MIT	20.0946	20.2593	20.4807	20.6290	20.6534	20.6605	20.6631	20.6630	20.6545	20.5748	20.3275	20.0642	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0946	20.2593	20.4807	20.6290	20.6534	20.6605	20.6631	20.6630	20.6545	20.5748	20.3275	20.0642	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9404	0.9002	0.7998	0.5942	0.4127	0.3059	0.2465	0.2906	0.4648	0.7445	0.9007	0.9498	(94)
Useful gains	552.5820	598.3955	621.2894	562.6696	445.1856	329.4043	252.6245	256.9595	347.9863	463.1695	509.0750	534.9752	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	750.1804	739.2834	684.3902	572.7824	446.2351	329.5308	252.6499	257.0288	349.5347	492.9470	626.8071	744.4884	(97)
Space heating kWh	147.0132	94.6766	46.9470	7.2812	0.7808	0.0000	0.0000	0.0000	0.0000	22.1544	84.7671	155.8778	(98a)

Space heating requirement - total per year (kWh/year) 559.4982

Solar heating kWh

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)

Solar heating contribution - total per year (kWh/year) 0.0000

Space heating kWh

147.0132	94.6766	46.9470	7.2812	0.7808	0.0000	0.0000	0.0000	0.0000	22.1544	84.7671	155.8778	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 559.4982

Space heating per m2 (98c) / (4) = 8.5289 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	147.0132	94.6766	46.9470	7.2812	0.7808	0.0000	0.0000	0.0000	0.0000	22.1544	84.7671	155.8778	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	147.0132	94.6766	46.9470	7.2812	0.7808	0.0000	0.0000	0.0000	0.0000	22.1544	84.7671	155.8778	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	12.1045	10.9331	12.1045	11.7141	12.1045	11.7141	12.1045	12.1045	11.7141	12.1045	11.7141	12.1045	(231)
Lighting	18.8229	15.1004	13.5963	9.9612	7.6943	6.2863	7.0190	9.1236	11.8506	15.5487	17.5622	19.3460	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.3335	-24.2496	-40.7429	-53.0154	-61.7317	-58.2186	-57.7804	-50.9772	-41.3377	-29.2830	-16.9564	-12.3241	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4576	-6.4518	-15.8354	-29.2573	-40.7194	-40.3248	-40.3981	-31.3264	-21.1298	-10.2536	-3.6695	-1.9361	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												559.4982	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2461.0688	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)													
mechanical ventilation fans (SFP = 0.7420)												142.5210	(230a)
Total electricity for the above, kWh/year												142.5210	(231)
Electricity for lighting (calculated in Appendix L)												151.9116	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-704.7104	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2610.2892	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	559.4982	25.1600	140.7697	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	25.1600	619.2049	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	142.5210	25.1600	35.8583	(249)
Energy for lighting	151.9116	25.1600	38.2210	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.9505	25.1600	-115.9752	
PV Unit electricity exported	-243.7598	5.8100	-14.1624	
Total			-130.1376	(252)
Total energy cost			703.9163	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	559.4982	0.1585	88.6595	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2461.0688	0.1413	347.7259	(264)
Space and water heating			436.3854	(265)
Pumps, fans and electric keep-hot	142.5210	0.1387	19.7694	(267)
Energy for lighting	151.9116	0.1443	21.9255	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.9505	0.1321	-60.8840	
PV Unit electricity exported	-243.7598	0.1225	-29.8531	
Total			-90.7371	(269)
Total CO2, kg/year			387.3433	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	559.4982	1.5865	887.6647	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	1.5225	3746.8812	(278)
Space and water heating			4634.5458	(279)
Pumps, fans and electric keep-hot	142.5210	1.5128	215.6057	(281)
Energy for lighting	151.9116	1.5338	233.0071	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.9505	1.4880	-685.9054	
PV Unit electricity exported	-243.7598	0.4495	-109.5580	
Total			-795.4634	(283)
Total Primary energy kWh/year			4287.6952	(286)

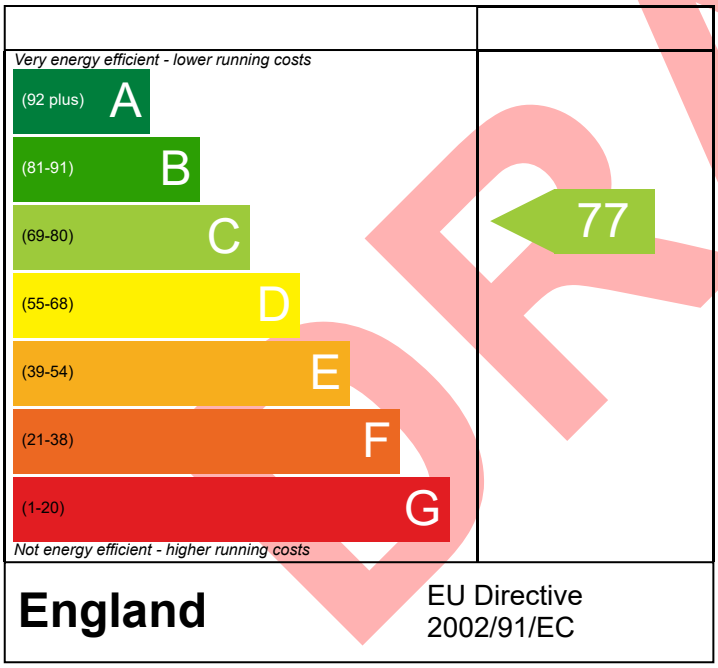
Predicted Energy Assessment

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	65.6 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

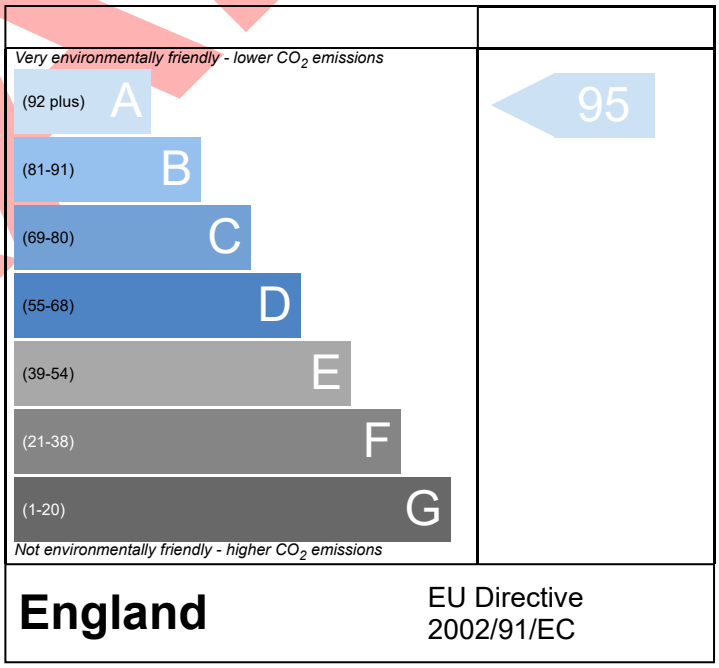
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:46

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	71 m^2
Site Reference	Unit 78 L04_Copy	Plot Reference	Unit 78 L04_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*10.3 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	4.64 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*55.61 kWh_{PE}/m^2*	
Dwelling primary energy	52.51 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*18.0 kWh/m^2*	
Dwelling fabric energy efficiency	17.1 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	11	0.14 **(!)**
Party wall: Party Wall (1)	52.62	0 **(!)**
Party wall: Party Wall (2)	15.55	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	11.81	North East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.92 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 78 L04_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 78 L04_Copy	**Prop Type Ref**	Unit 78 L04
Property			

SAP Rating	80 C	**DER**	4.64	**TER**	10.30
Environmental	96 A	**% DER < TER**			54.95
CO_2 Emissions (t/year)	0.33	**DFEE**	17.06	**TFEE**	17.98
Compliance Check	See BREL	**% DFEE < TFEE**			5.14
% DPER < TPER	5.58	**DPER**	52.51	**TPER**	55.61

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 14111.0700	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.8035	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545

E4 Jamb	13.9200	0.0500	0.6960	
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.8660 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.2026	16.0392	15.8758	15.0589	14.8955	14.0786	14.0786	13.9153	14.4054	14.8955	15.2223	15.5490	(38)
Heat transfer coeff	34.2027	34.0393	33.8759	33.0590	32.8956	32.0787	32.0787	31.9154	32.4055	32.8956	33.2224	33.5491	(39)

Average = Sum(39)m / 12 = 33.0182

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4819	0.4796	0.4773	0.4658	0.4634	0.4519	0.4519	0.4496	0.4565	0.4634	0.4681	0.4727	(40)
HLP (average)												0.4652	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2697 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day) 138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)

Energy content (annual) Total = Sum(45)m = 2297.5146

Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)

Total per year (kWh/year) = Sum(64)m = 2544.5466 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(75)

Solar gains	48.1118	97.9329	176.4440	289.7718	389.5101	415.2590	388.4663	309.6898	214.9998	119.6818	60.5371	39.2905	(83)
Total gains	594.4583	642.1364	703.7861	784.8198	853.3337	850.5024	806.5649	731.0038	652.3178	585.8947	562.0348	571.6354	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.6034	115.1535	115.7089	118.5680	119.1569	122.1913	122.1913	122.8168	120.9592	119.1569	117.9849	116.8358	
alpha	8.6402	8.6769	8.7139	8.9045	8.9438	9.1461	9.1461	9.1878	9.0639	8.9438	8.8657	8.7891	
util living area													
	0.8775	0.8131	0.6885	0.5091	0.3585	0.2414	0.1750	0.2008	0.3428	0.5819	0.7916	0.8914	(86)
MIT	20.8955	20.9454	20.9859	20.9990	21.0000	21.0000	21.0000	21.0000	21.0000	20.9975	20.9643	20.8857	(87)
Th 2	20.5375	20.5396	20.5417	20.5523	20.5544	20.5651	20.5651	20.5672	20.5608	20.5544	20.5502	20.5460	(88)
util rest of house													
	0.8633	0.7958	0.6685	0.4904	0.3413	0.2250	0.1577	0.1819	0.3210	0.5575	0.7712	0.8782	(89)
MIT 2	20.4234	20.4818	20.5277	20.5514	20.5544	20.5651	20.5651	20.5672	20.5608	20.5523	20.5139	20.4203	(90)
Living area fraction										fLA = Living area / (4) =		0.4060	(91)
MIT	20.6151	20.6700	20.7137	20.7331	20.7353	20.7417	20.7417	20.7429	20.7391	20.7331	20.6968	20.6093	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6151	20.6700	20.7137	20.7331	20.7353	20.7417	20.7417	20.7429	20.7391	20.7331	20.6968	20.6093	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8657	0.8008	0.6760	0.4979	0.3483	0.2316	0.1647	0.1896	0.3298	0.5673	0.7780	0.8801	(94)
Useful gains	514.6438	514.2072	475.7927	390.7925	297.2070	197.0168	132.8596	138.6063	215.1380	332.4041	437.2668	503.1190	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	558.0190	536.7995	481.5030	391.1911	297.2225	197.0170	132.8596	138.6063	215.1442	333.3337	451.7174	550.5165	(97)
Space heating kWh													
	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(98a)
Space heating requirement - total per year (kWh/year)												98.3601	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												98.3601	
Space heating per m2											(98c) / (4) =	1.3857	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)
Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.8048	-26.6478	-43.2456	-54.4944	-64.0203	-61.6099	-60.6290	-54.7463	-44.7493	-32.6681	-19.3717	-14.1696	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.4726	-8.1139	-18.0130	-29.9352	-41.8274	-42.9674	-42.3587	-34.2994	-23.4325	-12.3679	-4.8722	-2.6645	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	98.3601	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2544.5466	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	154.2094	(230a)
Total electricity for the above, kWh/year	154.2094	(231)
Electricity for lighting (calculated in Appendix L)	163.7369	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-757.4814	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2203.3717	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	98.3601	16.4900	16.2196	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	16.4900	419.5957	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	16.4900	25.4291	(249)
Energy for lighting	163.7369	16.4900	27.0002	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.1568	16.4900	-81.3216	
PV Unit electricity exported	-264.3246	5.5900	-14.7757	
Total			-96.0973	(252)
Total energy cost			392.1474	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2172	(257)
SAP value		80.2689	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	98.3601	0.1606	15.7950	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			375.3396	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.1568	0.1323	-65.2544	
PV Unit electricity exported	-264.3246	0.1234	-32.6244	
Total			-97.8788	(269)
Total CO2, kg/year			322.4838	(272)
CO2 emissions per m2			4.5400	(273)
EI value			96.2741	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14111.0700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 198.8035 (35)
List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4	Jamb	13.9200	0.0500	0.6960
E7	Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18	Party wall between dwellings	5.4000	0.0600	0.3240
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.8660 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3659	16.3659	16.0392	15.0589	14.8955	14.2420	13.9153	13.9153	14.5688	15.3857	15.7124	15.5490	(38)
Heat transfer coeff	34.3660	34.3660	34.0393	33.0590	32.8956	32.2421	31.9154	31.9154	32.5689	33.3858	33.7125	33.5491	(39)

Average = Sum(39)m / 12 = 33.1679

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4842	0.4842	0.4796	0.4658	0.4634	0.4542	0.4496	0.4496	0.4588	0.4704	0.4750	0.4727	(40)
HLP (average)												0.4673	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2697 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day) 138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
										Total per year (kWh/year) = Sum(64)m =		2544.5466	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)													
	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains													
	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(75)

Solar gains	42.7730	92.6022	174.0550	301.5827	403.2921	419.0362	396.3745	305.8819	210.3213	112.3593	55.2465	35.7661	(83)
Total gains	589.1195	636.8057	701.3971	796.6307	867.1157	854.2796	814.4731	727.1958	647.6393	578.5722	556.7443	568.1110	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.0586	114.0586	115.1535	118.5680	119.1569	121.5721	122.8168	122.8168	120.3524	117.4076	116.2696	116.8358	
alpha	8.6039	8.6039	8.6769	8.9045	8.9438	9.1048	9.1878	9.1878	9.0235	8.8272	8.7513	8.7891	
util living area													
	0.8948	0.8436	0.7313	0.5425	0.3907	0.2944	0.2390	0.2721	0.4123	0.6468	0.8263	0.9072	(86)
MIT	20.8725	20.9227	20.9763	20.9982	20.9999	21.0000	21.0000	21.0000	20.9999	20.9935	20.9463	20.8626	(87)
Th 2	20.5354	20.5354	20.5396	20.5523	20.5544	20.5630	20.5672	20.5672	20.5587	20.5481	20.5438	20.5460	(88)
util rest of house													
	0.8819	0.8278	0.7122	0.5242	0.3738	0.2779	0.2221	0.2531	0.3901	0.6222	0.8073	0.8955	(89)
MIT 2	20.3944	20.4521	20.5153	20.5506	20.5544	20.5629	20.5672	20.5672	20.5586	20.5421	20.4880	20.3930	(90)
Living area fraction										fLA = Living area / (4) =		0.4060	(91)
MIT	20.5885	20.6432	20.7024	20.7323	20.7353	20.7404	20.7429	20.7429	20.7378	20.7254	20.6741	20.5837	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5885	20.6432	20.7024	20.7323	20.7353	20.7404	20.7429	20.7429	20.7378	20.7254	20.6741	20.5837	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8835	0.8316	0.7190	0.5316	0.3807	0.2846	0.2290	0.2608	0.3991	0.6319	0.8129	0.8965	(94)
Useful gains	520.4584	529.5388	504.3299	423.4968	330.0802	243.1167	186.4792	189.6703	258.4856	365.5902	452.5648	509.3180	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	573.5183	561.6502	514.0764	424.2235	330.1165	243.1185	186.4794	189.6709	258.5247	368.0921	474.4733	566.4323	(97)
Space heating kWh													
	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930	(98a)
Space heating requirement - total per year (kWh/year)												128.9856	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												128.9856	
Space heating per m2										(98c) / (4) =		1.8172	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)

Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.2338	-25.6721	-43.2787	-56.7922	-66.2633	-62.5005	-62.0252	-54.7629	-44.4553	-31.3120	-18.0261	-13.1034	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.9401	-7.5576	-17.9590	-32.2559	-44.6250	-44.1582	-44.2385	-34.3187	-23.1566	-11.4806	-4.2984	-2.3312	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	128.9856	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2544.5466	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	154.2094	(230a)
Total electricity for the above, kWh/year	154.2094	(231)
Electricity for lighting (calculated in Appendix L)	163.7369	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-762.7453	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2228.7332	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	128.9856	25.1600	32.4528	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	25.1600	640.2079	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	25.1600	38.7991	(249)
Energy for lighting	163.7369	25.1600	41.1962	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.4255	25.1600	-124.1459	
PV Unit electricity exported	-269.3198	5.8100	-15.6475	
Total			-139.7933	(252)
Total energy cost			612.8627	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	128.9856	0.1600	20.6366	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			380.1811	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.4255	0.1320	-65.1384	
PV Unit electricity exported	-269.3198	0.1229	-33.1064	
Total			-98.2448	(269)
Total CO2, kg/year			326.9594	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	128.9856	1.5921	205.3619	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	1.5225	3874.0629	(278)
Space and water heating			4079.4248	(279)
Pumps, fans and electric keep-hot	154.2094	1.5128	233.2880	(281)
Energy for lighting	163.7369	1.5338	251.1452	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.4255	1.4878	-734.0970	
PV Unit electricity exported	-269.3198	0.4511	-121.5003	
Total			-855.5973	(283)
Total Primary energy kWh/year			3708.2608	(286)

SAP 10 EPC IMPROVEMENTS

Unit 78 L04_Copy

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 80
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£753	£753	£0
Space heating	£71	£71	£0
Water heating	£640	£640	£0
Lighting	£41	£41	£0
Generated (PV)	-£140	-£140	£0
Total cost of fuels	£613	£613	£0
Total cost of uses	£612	£612	£0
Delivered energy	31 kWh/m²	31 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	52 kWh/m²	52 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14111.0700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		198.8035 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.8660 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.2026	16.0392	15.8758	15.0589	14.8955	14.0786	14.0786	13.9153	14.4054	14.8955	15.2223	15.5490	(38)
Heat transfer coeff	34.2027	34.0393	33.8759	33.0590	32.8956	32.0787	32.0787	31.9154	32.4055	32.8956	33.2224	33.5491	(39)
Average = Sum(39)m / 12 =												33.0182	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4819	0.4796	0.4773	0.4658	0.4634	0.4519	0.4519	0.4496	0.4565	0.4634	0.4681	0.4727	(40)
HLP (average)												0.4652	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.2697 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)

Hot water usage for baths

26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)

Hot water usage for other uses

37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day)		138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
									Total per year (kWh/year) = Sum(64)m =		2544.5466	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast				11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(75)
Solar gains	48.1118	97.9329	176.4440	289.7718	389.5101	415.2590	388.4663	309.6898	214.9998	119.6818	60.5371	39.2905	(83)
Total gains	594.4583	642.1364	703.7861	784.8198	853.3337	850.5024	806.5649	731.0038	652.3178	585.8947	562.0348	571.6354	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.6034	115.1535	115.7089	118.5680	119.1569	122.1913	122.1913	122.8168	120.9592	119.1569	117.9849	116.8358	
alpha	8.6402	8.6769	8.7139	8.9045	8.9438	9.1461	9.1461	9.1878	9.0639	8.9438	8.8657	8.7891	
util living area	0.8775	0.8131	0.6885	0.5091	0.3585	0.2414	0.1750	0.2008	0.3428	0.5819	0.7916	0.8914	(86)
MIT	20.8955	20.9454	20.9859	20.9990	21.0000	21.0000	21.0000	21.0000	21.0000	20.9975	20.9643	20.8857	(87)
Th 2	20.5375	20.5396	20.5417	20.5523	20.5544	20.5651	20.5651	20.5672	20.5608	20.5544	20.5502	20.5460	(88)
util rest of house	0.8633	0.7958	0.6685	0.4904	0.3413	0.2250	0.1577	0.1819	0.3210	0.5575	0.7712	0.8782	(89)
MIT 2	20.4234	20.4818	20.5277	20.5514	20.5544	20.5651	20.5651	20.5672	20.5608	20.5523	20.5139	20.4203	(90)
Living area fraction									fLA = Living area / (4) =			0.4060	(91)
MIT	20.6151	20.6700	20.7137	20.7331	20.7353	20.7417	20.7417	20.7429	20.7391	20.7331	20.6968	20.6093	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6151	20.6700	20.7137	20.7331	20.7353	20.7417	20.7417	20.7429	20.7391	20.7331	20.6968	20.6093	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8657	0.8008	0.6760	0.4979	0.3483	0.2316	0.1647	0.1896	0.3298	0.5673	0.7780	0.8801	(94)
Useful gains	514.6438	514.2072	475.7927	390.7925	297.2070	197.0168	132.8596	138.6063	215.1380	332.4041	437.2668	503.1190	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	558.0190	536.7995	481.5030	391.1911	297.2225	197.0170	132.8596	138.6063	215.1442	333.3337	451.7174	550.5165	(97)
Space heating kWh	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(98a)
Space heating requirement - total per year (kWh/year)												98.3601	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												98.3601	
Space heating per m2										(98c) / (4) =		1.3857	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)
Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.8048	-26.6478	-43.2456	-54.4944	-64.0203	-61.6099	-60.6290	-54.7463	-44.7493	-32.6681	-19.3717	-14.1696	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.4726	-8.1139	-18.0130	-29.9352	-41.8274	-42.9674	-42.3587	-34.2994	-23.4325	-12.3679	-4.8722	-2.6645	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												98.3601	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2544.5466	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	154.2094	(230a)
Total electricity for the above, kWh/year	154.2094	(231)
Electricity for lighting (calculated in Appendix L)	163.7369	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-757.4814	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2203.3717	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	98.3601	16.4900	16.2196	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	16.4900	419.5957	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	16.4900	25.4291	(249)
Energy for lighting	163.7369	16.4900	27.0002	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.1568	16.4900	-81.3216	
PV Unit electricity exported	-264.3246	5.5900	-14.7757	
Total			-96.0973	(252)
Total energy cost			392.1474	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2172	(257)
SAP value		80.2689	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	98.3601	0.1606	15.7950	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			375.3396	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.1568	0.1323	-65.2544	
PV Unit electricity exported	-264.3246	0.1234	-32.6244	
Total			-97.8788	(269)
Total CO2, kg/year			322.4838	(272)
CO2 emissions per m2			4.5400	(273)
EI value			96.2741	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		70.9800	(1b)	x 2.4000	(2b) =	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		170.3520	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 14111.0700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.8035 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	1.8660 (36)
Point Thermal bridges (36a) =	0.0000
Total fabric heat loss (33) + (36) + (36a) =	18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3659	16.3659	16.0392	15.0589	14.8955	14.2420	13.9153	13.9153	14.5688	15.3857	15.7124	15.5490	(38)
Heat transfer coeff	34.3660	34.3660	34.0393	33.0590	32.8956	32.2421	31.9154	31.9154	32.5689	33.3858	33.7125	33.5491	(39)
Average = Sum(39)m / 12 =												33.1679	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4842	0.4842	0.4796	0.4658	0.4634	0.4542	0.4496	0.4496	0.4588	0.4704	0.4750	0.4727	(40)
HLP (average)												0.4673	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2697 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)
Average daily hot water use (litres/day)												138.3203	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
									Total per year (kWh/year) = Sum(64)m =			2544.5466	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(75)

Solar gains	42.7730	92.6022	174.0550	301.5827	403.2921	419.0362	396.3745	305.8819	210.3213	112.3593	55.2465	35.7661	(83)
Total gains	589.1195	636.8057	701.3971	796.6307	867.1157	854.2796	814.4731	727.1958	647.6393	578.5722	556.7443	568.1110	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.0586	114.0586	115.1535	118.5680	119.1569	121.5721	122.8168	122.8168	120.3524	117.4076	116.2696	116.8358	
alpha	8.6039	8.6039	8.6769	8.9045	8.9438	9.1048	9.1878	9.1878	9.0235	8.8272	8.7513	8.7891	
util living area	0.8948	0.8436	0.7313	0.5425	0.3907	0.2944	0.2390	0.2721	0.4123	0.6468	0.8263	0.9072	(86)
MIT	20.8725	20.9227	20.9763	20.9982	20.9999	21.0000	21.0000	21.0000	20.9999	20.9935	20.9463	20.8626	(87)
Th 2	20.5354	20.5354	20.5396	20.5523	20.5544	20.5630	20.5672	20.5672	20.5587	20.5481	20.5438	20.5460	(88)
util rest of house	0.8819	0.8278	0.7122	0.5242	0.3738	0.2779	0.2221	0.2531	0.3901	0.6222	0.8073	0.8955	(89)
MIT 2	20.3944	20.4521	20.5153	20.5506	20.5544	20.5629	20.5672	20.5672	20.5586	20.5421	20.4880	20.3930	(90)
Living area fraction										fLA = Living area / (4) =		0.4060	(91)
MIT	20.5885	20.6432	20.7024	20.7323	20.7353	20.7404	20.7429	20.7429	20.7378	20.7254	20.6741	20.5837	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5885	20.6432	20.7024	20.7323	20.7353	20.7404	20.7429	20.7429	20.7378	20.7254	20.6741	20.5837	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8835	0.8316	0.7190	0.5316	0.3807	0.2846	0.2290	0.2608	0.3991	0.6319	0.8129	0.8965	(94)
Useful gains	520.4584	529.5388	504.3299	423.4968	330.0802	243.1167	186.4792	189.6703	258.4856	365.5902	452.5648	509.3180	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	573.5183	561.6502	514.0764	424.2235	330.1165	243.1185	186.4794	189.6709	258.5247	368.0921	474.4733	566.4323	(97)
Space heating kWh	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930	(98a)
Space heating requirement - total per year (kWh/year)												128.9856	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												128.9856	
Space heating per m2											(98c) / (4) =	1.8172	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													

	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972 (231)
Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-15.2338	-25.6721	-43.2787	-56.7922	-66.2633	-62.5005	-62.0252	-54.7629	-44.4553	-31.3120	-18.0261	-13.1034 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.9401	-7.5576	-17.9590	-32.2559	-44.6250	-44.1582	-44.2385	-34.3187	-23.1566	-11.4806	-4.2984	-2.3312 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	128.9856 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2544.5466 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	154.2094 (230a)
Total electricity for the above, kWh/year	154.2094 (231)
Electricity for lighting (calculated in Appendix L)	163.7369 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-762.7453 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2228.7332 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	128.9856	25.1600	32.4528	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	25.1600	640.2079	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	25.1600	38.7991	(249)
Energy for lighting	163.7369	25.1600	41.1962	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.4255	25.1600	-124.1459	
PV Unit electricity exported	-269.3198	5.8100	-15.6475	
Total			-139.7933	(252)
Total energy cost			612.8627	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	128.9856	0.1600	20.6366	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			380.1811	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.4255	0.1320	-65.1384	
PV Unit electricity exported	-269.3198	0.1229	-33.1064	
Total			-98.2448	(269)
Total CO2, kg/year			326.9594	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	128.9856	1.5921	205.3619	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	1.5225	3874.0629	(278)
Space and water heating			4079.4248	(279)

Pumps, fans and electric keep-hot	154.2094	1.5128	233.2880	(281)
Energy for lighting	163.7369	1.5338	251.1452	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.4255	1.4878	-734.0970	
PV Unit electricity exported	-269.3198	0.4511	-121.5003	
Total			-855.5973	(283)
Total Primary energy kWh/year			3708.2608	(286)

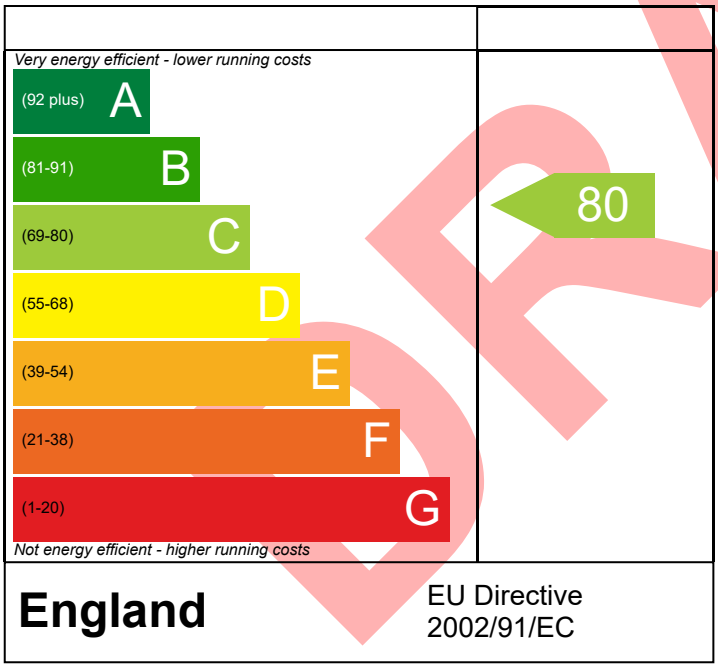
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	70.98 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

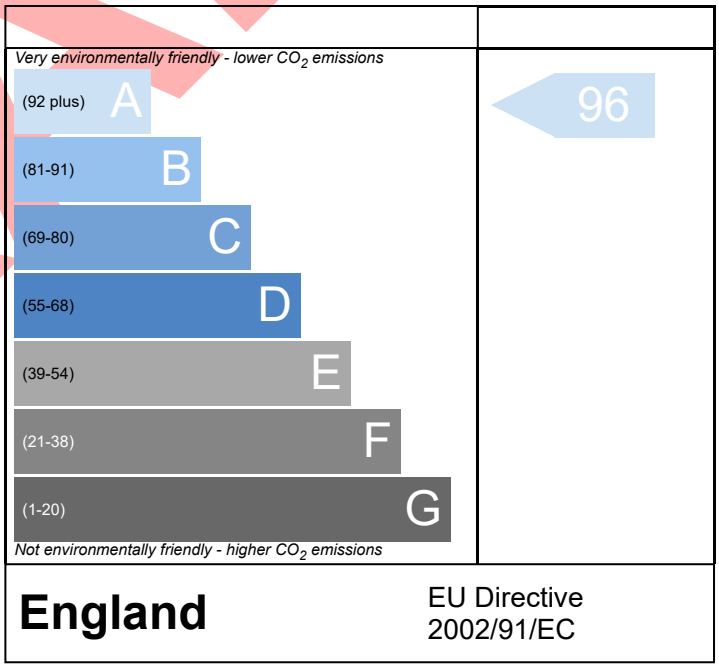
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:47

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	66 m^2
Site Reference	Unit 79 L04_Copy	Plot Reference	Unit 79 L04_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.14 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	5.32 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*60.16 kWh_{PE}/m^2*	
Dwelling primary energy	59.44 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*21.4 kWh/m^2*	
Dwelling fabric energy efficiency	21.6 kWh/m^2	FAIL

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	25.12	0.14 **(!)**
Party wall: Party Wall (1)	55.02	0 **(!)**
Party wall: Party Wall (2)	3.85	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SE, Opening Type 1	11.81	South East	0.83	1.3
NE, Opening Type 1	7.88	North East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.86 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 79 L04_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 79 L04_Copy	**Prop Type Ref**	Unit 79 L04
Property			

SAP Rating	78 C	**DER**	5.32	**TER**	11.14
Environmental	96 A	**% DER < TER**			52.24
CO_2 Emissions (t/year)	0.36	**DFEE**	21.59	**TFEE**	21.38
Compliance Check	See BREL	**% DFEE < TFEE**			-0.98
% DPER < TPER	1.20	**DPER**	59.44	**TPER**	60.16

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		66.4100 (1b)	x	2.4000 (2b)	=	159.3840	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.4100						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.3840	(5)

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2. Ventilation rate

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				m3 per hour
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		0 * 10 =	0.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.8100	19.6900	25.1200	0.1400	3.5168	14.0000	351.6800	(29a)
Total net area of external elements Aum(A, m2)			44.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.8485			(33)
Party Wall 1			55.0200	0.0000	0.0000	20.0000	1100.4000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.4100			80.0000	5312.8000	(32d)
Party Ceiling 1			66.4100			80.0000	5312.8000	(32b)
Internal Wall 1			140.4500			9.0000	1264.0500	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 13418.7300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	202.0589	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240

E4 Jamb	23.2000	0.0500	1.1600	
E7 Party floor between dwellings (in blocks of flats)	16.5900	0.0700	1.1613	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	21.8000	0.0000	0.0000	
E16 Corner (normal)	5.4000	0.0900	0.4860	
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				3.5553 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	31.4038 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.9138	15.7461	15.5785	14.7402	14.5726	13.7343	13.7343	13.5667	14.0696	14.5726	14.9079	15.2432	(38)
Heat transfer coeff	47.3176	47.1500	46.9823	46.1441	45.9764	45.1382	45.1382	44.9705	45.4735	45.9764	46.3117	46.6470	(39)
Average = Sum(39)m / 12 =												46.1022	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7125	0.7100	0.7075	0.6948	0.6923	0.6797	0.6797	0.6772	0.6847	0.6923	0.6974	0.7024	(40)
HLP (average)												0.6942	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.1559	(42)
Hot water usage for mixer showers	83.0050	81.7576	79.9399	76.4620	73.8955	71.0332	69.4063	71.2103	73.1878	76.2609	79.8135	82.6870	(42a)
Hot water usage for baths	26.0831	25.6958	25.1503	24.1445	23.3913	22.5562	22.1051	22.6468	23.2366	24.1302	25.1567	25.9950	(42b)
Hot water usage for other uses	36.7088	35.3739	34.0390	32.7042	31.3693	30.0344	30.0344	31.3693	32.7042	34.0390	35.3739	36.7088	(42c)
Average daily hot water use (litres/day)												134.0826	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7969	142.8273	139.1292	133.3107	128.6561	123.6239	121.5459	125.2264	129.1285	134.4302	140.3441	145.3907	(44)
Energy conte	230.9067	203.3841	213.8364	182.4956	173.1958	152.0100	146.9993	155.0565	159.2284	182.4205	199.9459	227.6467	(45)
Energy content (annual)											Total = Sum(45)m =	2227.1258	
Distribution loss (46)m = 0.15 x (45)m	34.6360	30.5076	32.0755	27.3743	25.9794	22.8015	22.0499	23.2585	23.8843	27.3631	29.9919	34.1470	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
										Total per year (kWh/year) = Sum(64)m =		2474.1578	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	93.5611	82.7855	87.8852	76.9230	74.3722	66.7865	65.6619	68.3409	69.1866	77.4394	82.7252	92.4772	(65)

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5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7302	19.3006	15.6963	11.8831	8.8827	7.4992	8.1031	10.5328	14.1371	17.9502	20.9506	22.3341	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.7577	284.6815	277.3137	261.6285	241.8288	223.2199	210.7880	207.8643	215.2321	230.9172	250.7169	269.3258	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	(71)
Water heating gains (Table 5)	125.7542	123.1928	118.1253	106.8375	99.9627	92.7591	88.2552	91.8561	96.0926	104.0853	114.8961	124.2973	(72)
Total internal gains	522.4518	520.3846	504.3451	473.5589	443.8841	416.6880	400.3562	403.4629	418.6715	446.1625	479.7734	509.1670	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(75)
Southeast	11.8100	36.7938	0.6300	0.8270	0.7700	156.8932	(77)

Solar gains	188.9949	332.5911	483.3882	646.4144	767.3690	780.8797	744.9195	651.7680	539.3863	375.2206	228.3142	160.4838	(83)
Total gains	711.4468	852.9757	987.7333	1119.9732	1211.2531	1197.5676	1145.2757	1055.2309	958.0577	821.3831	708.0876	669.6508	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.7745	79.0546	79.3367	80.7780	81.0725	82.5781	82.5781	82.8860	81.9692	81.0725	80.4855	79.9070	
alpha	6.2516	6.2703	6.2891	6.3852	6.4048	6.5052	6.5052	6.5257	6.4646	6.4048	6.3657	6.3271	
util living area	0.9030	0.8075	0.6675	0.4956	0.3527	0.2412	0.1734	0.1960	0.3273	0.5744	0.8198	0.9213	(86)
MIT	20.6897	20.8522	20.9540	20.9930	20.9993	21.0000	21.0000	21.0000	20.9997	20.9866	20.8667	20.6491	(87)
Th 2	20.3298	20.3320	20.3342	20.3454	20.3476	20.3588	20.3588	20.3610	20.3543	20.3476	20.3432	20.3387	(88)
util rest of house	0.8881	0.7855	0.6410	0.4695	0.3281	0.2171	0.1481	0.1688	0.2968	0.5404	0.7950	0.9085	(89)
MIT 2	19.9885	20.1767	20.2890	20.3392	20.3471	20.3588	20.3588	20.3610	20.3541	20.3361	20.2070	19.9486	(90)
Living area fraction										fLA = Living area / (4) =		0.3439	(91)
MIT	20.2297	20.4090	20.5177	20.5640	20.5714	20.5793	20.5793	20.5808	20.5761	20.5598	20.4339	20.1896	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2297	20.4090	20.5177	20.5640	20.5714	20.5793	20.5793	20.5808	20.5761	20.5598	20.4339	20.1896	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8857	0.7881	0.6484	0.4782	0.3365	0.2254	0.1568	0.1782	0.3073	0.5516	0.7986	0.9054	(94)
Useful gains	630.1308	672.2506	640.4892	535.6178	407.6196	269.8816	179.6187	188.0104	294.3932	453.0509	565.4734	606.2927	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	753.7551	731.2498	658.5834	538.2263	407.8736	269.8945	179.6196	188.0124	294.4927	457.9172	617.5145	745.8656	(97)
Space heating kWh	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(98a)
Space heating requirement - total per year (kWh/year)												292.0855	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												292.0855	
Space heating per m2										(98c) / (4) =		4.3982	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5604	10.4416	11.5604	11.1874	11.5604	11.1874	11.5604	11.5604	11.1874	11.5604	11.1874	11.5604	(231)
Lighting	19.0203	15.2588	13.7389	10.0657	7.7750	6.3523	7.0926	9.2193	11.9749	15.7117	17.7464	19.5489	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.9020	-25.1650	-40.7355	-51.2571	-60.2242	-57.9694	-57.0463	-51.4863	-42.0498	-30.6941	-18.2779	-13.4134	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.0531	-7.3297	-16.5280	-27.6662	-38.7205	-39.7876	-39.2248	-31.7520	-21.6853	-11.4048	-4.3848	-2.3228	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

Space heating fuel - main system 1	292.0855	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2474.1578	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.1139	(230a)
Total electricity for the above, kWh/year	136.1139	(231)
Electricity for lighting (calculated in Appendix L)	153.5048	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-708.0805	(233)
Wind generation	0.0000	(234)

Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2347.7816	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	292.0855	16.4900	48.1649	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	16.4900	407.9886	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	136.1139	16.4900	22.4452	(249)
Energy for lighting	153.5048	16.4900	25.3129	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.2208	16.4900	-76.5500	
PV Unit electricity exported	-243.8596	5.5900	-13.6318	
Total			-90.1818	(252)
Total energy cost			413.7299	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.3369	(257)
SAP value		78.3290	
SAP rating (Section 12)		78	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	292.0855	0.1601	46.7656	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2474.1578	0.1413	349.5790	(264)
Space and water heating			396.3446	(265)
Pumps, fans and electric keep-hot	136.1139	0.1387	18.8807	(267)
Energy for lighting	153.5048	0.1443	22.1555	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.2208	0.1323	-61.4360	
PV Unit electricity exported	-243.8596	0.1232	-30.0483	
Total			-91.4843	(269)
Total CO2, kg/year			345.8964	(272)
CO2 emissions per m2			5.2100	(273)
EI value			95.8397	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		66.4100 (1b)	x	2.4000 (2b)	=	159.3840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.4100						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.3840	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.8100	19.6900	25.1200	0.1400	3.5168	14.0000	351.6800	(29a)
Total net area of external elements Aum(A, m2)			44.8100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.8485			(33)
Party Wall 1			55.0200	0.0000	0.0000	20.0000	1100.4000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.4100			80.0000	5312.8000	(32d)
Party Ceiling 1			66.4100			80.0000	5312.8000	(32b)
Internal Wall 1			140.4500			9.0000	1264.0500	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13418.7300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 202.0589 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.5900	0.0700	1.1613
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	21.8000	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.5553 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 31.4038 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.0814	16.0814	15.7461	14.7402	14.5726	13.9020	13.5667	13.5667	14.2373	15.0755	15.4108	15.2432	(38)
Heat transfer coeff	47.4853	47.4853	47.1500	46.1441	45.9764	45.3058	44.9705	44.9705	45.6411	46.4794	46.8147	46.6470	(39)

Average = Sum(39)m / 12 = 46.2558

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7150	0.7150	0.7100	0.6948	0.6923	0.6822	0.6772	0.6772	0.6873	0.6999	0.7049	0.7024	(40)
HLP (average)												0.6965	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1559 (42)
Hot water usage for mixer showers

83.0050	81.7576	79.9399	76.4620	73.8955	71.0332	69.4063	71.2103	73.1878	76.2609	79.8135	82.6870	(42a)

Hot water usage for baths

26.0831	25.6958	25.1503	24.1445	23.3913	22.5562	22.1051	22.6468	23.2366	24.1302	25.1567	25.9950	(42b)

Hot water usage for other uses

36.7088	35.3739	34.0390	32.7042	31.3693	30.0344	30.0344	31.3693	32.7042	34.0390	35.3739	36.7088	(42c)

Average daily hot water use (litres/day) 134.0826 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7969	142.8273	139.1292	133.3107	128.6561	123.6239	121.5459	125.2264	129.1285	134.4302	140.3441	145.3907	(44)
Energy conte	230.9067	203.3841	213.8364	182.4956	173.1958	152.0100	146.9993	155.0565	159.2284	182.4205	199.9459	227.6467	(45)
Energy content (annual)										Total = Sum(45)m =		2227.1258	
Distribution loss (46)m = 0.15 x (45)m	34.6360	30.5076	32.0755	27.3743	25.9794	22.8015	22.0499	23.2585	23.8843	27.3631	29.9919	34.1470	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
									Total per year (kWh/year) = Sum(64)m =		2474.1578	(64)
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

93.5611	82.7855	87.8852	76.9230	74.3722	66.7865	65.6619	68.3409	69.1866	77.4394	82.7252	92.4772	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	21.7302	19.3006	15.6963	11.8831	8.8827	7.4992	8.1031	10.5328	14.1371	17.9502	20.9506	22.3341	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	281.7577	284.6815	277.3137	261.6285	241.8288	223.2199	210.7880	207.8643	215.2321	230.9172	250.7169	269.3258	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	(71)

Water heating gains (Table 5)

	125.7542	123.1928	118.1253	106.8375	99.9627	92.7591	88.2552	91.8561	96.0926	104.0853	114.8961	124.2973	(72)

Total internal gains

	522.4518	520.3846	504.3451	473.5589	443.8841	416.6880	400.3562	403.4629	418.6715	446.1625	479.7734	509.1670	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(75)
Southeast	11.8100	33.4622	0.6300	0.8270	0.7700	142.6869	(77)

Solar gains	171.2264	321.1940	487.0707	684.6820	805.1181	796.7968	769.3033	653.9832	538.3810	359.9515	212.5016	148.7415	(83)
Total gains	693.6782	841.5786	991.4157	1158.2409	1249.0022	1213.4847	1169.6595	1057.4461	957.0525	806.1140	692.2750	657.9085	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.4964	78.4964	79.0546	80.7780	81.0725	82.2725	82.8860	82.8860	81.6681	80.1952	79.6208	79.9070	
alpha	6.2331	6.2331	6.2703	6.3852	6.4048	6.4848	6.5257	6.5257	6.4445	6.3463	6.3081	6.3271	
util living area	0.9197	0.8349	0.7014	0.5179	0.3787	0.2911	0.2345	0.2636	0.3905	0.6359	0.8514	0.9346	(86)
MIT	20.6348	20.8103	20.9354	20.9903	20.9988	20.9998	21.0000	20.9999	20.9989	20.9734	20.8218	20.5957	(87)
Th 2	20.3276	20.3276	20.3320	20.3454	20.3476	20.3566	20.3610	20.3610	20.3521	20.3409	20.3365	20.3387	(88)
util rest of house	0.9069	0.8149	0.6763	0.4930	0.3548	0.2672	0.2100	0.2365	0.3598	0.6026	0.8294	0.9237	(89)
MIT 2	19.9210	20.1249	20.2669	20.3365	20.3466	20.3564	20.3610	20.3610	20.3513	20.3170	20.1505	19.8839	(90)
Living area fraction									fLA = Living area / (4) =			0.3439	(91)
MIT	20.1665	20.3606	20.4968	20.5613	20.5709	20.5777	20.5808	20.5807	20.5740	20.5428	20.3814	20.1287	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1665	20.3606	20.4968	20.5613	20.5709	20.5777	20.5808	20.5807	20.5740	20.5428	20.3814	20.1287	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9035	0.8159	0.6826	0.5012	0.3630	0.2754	0.2184	0.2458	0.3703	0.6129	0.8309	0.9199	(94)
Useful gains	626.7471	686.6584	676.6978	580.5582	453.3870	334.1970	255.4576	259.9424	354.4406	494.0662	575.2427	605.2281	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	772.4183	762.6420	702.3835	584.2461	453.8286	334.2536	255.4673	259.9631	354.8138	503.9653	645.1697	766.3484	(97)
Space heating kWh	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(98a)
Space heating requirement - total per year (kWh/year)												359.1203	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												359.1203	
Space heating per m2										(98c) / (4) =		5.4076	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
Efficiency of water heater												100.0000	(216)

(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5604	10.4416	11.5604	11.1874	11.5604	11.1874	11.5604	11.5604	11.1874	11.5604	11.1874	11.5604	(231)
Lighting	19.0203	15.2588	13.7389	10.0657	7.7750	6.3523	7.0926	9.2193	11.9749	15.7117	17.7464	19.5489	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.4219	-24.2665	-40.8039	-53.4428	-62.3485	-58.8113	-58.3661	-51.5020	-41.7727	-29.4443	-17.0276	-12.4092	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.5668	-6.7960	-16.4400	-29.7978	-41.3079	-40.8915	-40.9673	-31.7699	-21.4298	-10.5575	-3.8409	-2.0189	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	359.1203	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2474.1578	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.1139	(230a)
Total electricity for the above, kWh/year	136.1139	(231)
Electricity for lighting (calculated in Appendix L)	153.5048	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-713.0011	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2409.8957	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	359.1203	25.1600	90.3547	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	25.1600	622.4981	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	136.1139	25.1600	34.2463	(249)
Energy for lighting	153.5048	25.1600	38.6218	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.6169	25.1600	-116.8976	
PV Unit electricity exported	-248.3842	5.8100	-14.4311	
Total			-131.3287	(252)
Total energy cost			654.3921	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	359.1203	0.1596	57.3260	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2474.1578	0.1413	349.5790	(264)
Space and water heating			406.9051	(265)
Pumps, fans and electric keep-hot	136.1139	0.1387	18.8807	(267)
Energy for lighting	153.5048	0.1443	22.1555	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.6169	0.1320	-61.3475	
PV Unit electricity exported	-248.3842	0.1227	-30.4782	
Total			-91.8258	(269)
Total CO2, kg/year			356.1155	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	359.1203	1.5908	571.2751	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	1.5225	3766.8228	(278)
Space and water heating			4338.0979	(279)
Pumps, fans and electric keep-hot	136.1139	1.5128	205.9132	(281)
Energy for lighting	153.5048	1.5338	235.4508	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.6169	1.4879	-691.2826	
PV Unit electricity exported	-248.3842	0.4503	-111.8546	
Total			-803.1371	(283)
Total Primary energy kWh/year			3976.3248	(286)

SAP 10 EPC IMPROVEMENTS

Unit 79 L04_Copy

Current energy efficiency rating: C 78
Current environmental impact rating: A 96

N Solar water heating	Not applicable
U Solar photovoltaic panels	Not applicable
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 78
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£786	£786	£0
Space heating	£125	£125	£0
Water heating	£622	£622	£0
Lighting	£39	£39	£0
Generated (PV)	-£131	-£131	£0
Total cost of fuels	£655	£655	£0
Total cost of uses	£655	£655	£0
Delivered energy	36 kWh/m²	36 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	60 kWh/m²	60 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.4100 (1b)	x	2.4000 (2b)	=	159.3840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.4100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.3840	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.8100	19.6900	25.1200	0.1400	3.5168	14.0000	351.6800	(29a)
Total net area of external elements Aum(A, m2)			44.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.8485			(33)
Party Wall 1			55.0200	0.0000	0.0000	20.0000	1100.4000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.4100			80.0000	5312.8000	(32d)
Party Ceiling 1			66.4100			80.0000	5312.8000	(32b)
Internal Wall 1			140.4500			9.0000	1264.0500	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13418.7300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 202.0589 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240	
E4 Jamb	23.2000	0.0500	1.1600	
E7 Party floor between dwellings (in blocks of flats)	16.5900	0.0700	1.1613	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	21.8000	0.0000	0.0000	
E16 Corner (normal)	5.4000	0.0900	0.4860	
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.5553 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 31.4038 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.9138	15.7461	15.5785	14.7402	14.5726	13.7343	13.7343	13.5667	14.0696	14.5726	14.9079	15.2432	(38)
Heat transfer coeff	47.3176	47.1500	46.9823	46.1441	45.9764	45.1382	45.1382	44.9705	45.4735	45.9764	46.3117	46.6470	(39)
Average = Sum(39)m / 12 =												46.1022	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7125	0.7100	0.7075	0.6948	0.6923	0.6797	0.6797	0.6772	0.6847	0.6923	0.6974	0.7024	(40)
HLP (average)												0.6942	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1559 (42)
Hot water usage for mixer showers

83.0050	81.7576	79.9399	76.4620	73.8955	71.0332	69.4063	71.2103	73.1878	76.2609	79.8135	82.6870	(42a)

Hot water usage for baths

26.0831	25.6958	25.1503	24.1445	23.3913	22.5562	22.1051	22.6468	23.2366	24.1302	25.1567	25.9950	(42b)

Hot water usage for other uses

36.7088	35.3739	34.0390	32.7042	31.3693	30.0344	30.0344	31.3693	32.7042	34.0390	35.3739	36.7088	(42c)

Average daily hot water use (litres/day) 134.0826 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7969	142.8273	139.1292	133.3107	128.6561	123.6239	121.5459	125.2264	129.1285	134.4302	140.3441	145.3907	(44)
Energy conte	230.9067	203.3841	213.8364	182.4956	173.1958	152.0100	146.9993	155.0565	159.2284	182.4205	199.9459	227.6467	(45)
Energy content (annual)										Total = Sum(45)m =		2227.1258	
Distribution loss (46)m = 0.15 x (45)m	34.6360	30.5076	32.0755	27.3743	25.9794	22.8015	22.0499	23.2585	23.8843	27.3631	29.9919	34.1470	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
									Total per year (kWh/year) = Sum(64)m =			2474.1578	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	93.5611	82.7855	87.8852	76.9230	74.3722	66.7865	65.6619	68.3409	69.1866	77.4394	82.7252	92.4772	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7302	19.3006	15.6963	11.8831	8.8827	7.4992	8.1031	10.5328	14.1371	17.9502	20.9506	22.3341	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.7577	284.6815	277.3137	261.6285	241.8288	223.2199	210.7880	207.8643	215.2321	230.9172	250.7169	269.3258	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	(71)
Water heating gains (Table 5)													

	125.7542	123.1928	118.1253	106.8375	99.9627	92.7591	88.2552	91.8561	96.0926	104.0853	114.8961	124.2973	(72)
Total internal gains													
	522.4518	520.3846	504.3451	473.5589	443.8841	416.6880	400.3562	403.4629	418.6715	446.1625	479.7734	509.1670	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(75)
Southeast	11.8100	36.7938	0.6300	0.8270	0.7700	156.8932	(77)

Solar gains	188.9949	332.5911	483.3882	646.4144	767.3690	780.8797	744.9195	651.7680	539.3863	375.2206	228.3142	160.4838	(83)
Total gains	711.4468	852.9757	987.7333	1119.9732	1211.2531	1197.5676	1145.2757	1055.2309	958.0577	821.3831	708.0876	669.6508	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.7745	79.0546	79.3367	80.7780	81.0725	82.5781	82.5781	82.8860	81.9692	81.0725	80.4855	79.9070	
alpha	6.2516	6.2703	6.2891	6.3852	6.4048	6.5052	6.5052	6.5257	6.4646	6.4048	6.3657	6.3271	
util living area													
	0.9030	0.8075	0.6675	0.4956	0.3527	0.2412	0.1734	0.1960	0.3273	0.5744	0.8198	0.9213	(86)
MIT	20.6897	20.8522	20.9540	20.9930	20.9993	21.0000	21.0000	21.0000	20.9997	20.9866	20.8667	20.6491	(87)
Th 2	20.3298	20.3320	20.3342	20.3454	20.3476	20.3588	20.3588	20.3610	20.3543	20.3476	20.3432	20.3387	(88)
util rest of house													
	0.8881	0.7855	0.6410	0.4695	0.3281	0.2171	0.1481	0.1688	0.2968	0.5404	0.7950	0.9085	(89)
MIT 2	19.9885	20.1767	20.2890	20.3392	20.3471	20.3588	20.3588	20.3610	20.3541	20.3361	20.2070	19.9486	(90)
Living area fraction										fLA = Living area / (4) =		0.3439	(91)
MIT	20.2297	20.4090	20.5177	20.5640	20.5714	20.5793	20.5793	20.5808	20.5761	20.5598	20.4339	20.1896	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2297	20.4090	20.5177	20.5640	20.5714	20.5793	20.5793	20.5808	20.5761	20.5598	20.4339	20.1896	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8857	0.7881	0.6484	0.4782	0.3365	0.2254	0.1568	0.1782	0.3073	0.5516	0.7986	0.9054	(94)
Useful gains	630.1308	672.2506	640.4892	535.6178	407.6196	269.8816	179.6187	188.0104	294.3932	453.0509	565.4734	606.2927	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	753.7551	731.2498	658.5834	538.2263	407.8736	269.8945	179.6196	188.0124	294.4927	457.9172	617.5145	745.8656	(97)
Space heating kWh													
	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(98a)
Space heating requirement - total per year (kWh/year)												292.0855	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												292.0855	
Space heating per m2											(98c) / (4) =	4.3982	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5604	10.4416	11.5604	11.1874	11.5604	11.1874	11.5604	11.5604	11.1874	11.5604	11.1874	11.5604	(231)
Lighting	19.0203	15.2588	13.7389	10.0657	7.7750	6.3523	7.0926	9.2193	11.9749	15.7117	17.7464	19.5489	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.9020	-25.1650	-40.7355	-51.2571	-60.2242	-57.9694	-57.0463	-51.4863	-42.0498	-30.6941	-18.2779	-13.4134	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													

(233b)m	-3.0531	-7.3297	-16.5280	-27.6662	-38.7205	-39.7876	-39.2248	-31.7520	-21.6853	-11.4048	-4.3848	-2.3228	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	292.0855	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2474.1578	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.1139	(230a)
Total electricity for the above, kWh/year	136.1139	(231)
Electricity for lighting (calculated in Appendix L)	153.5048	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-708.0805	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2347.7816	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	292.0855	16.4900	48.1649	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	16.4900	407.9886	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	136.1139	16.4900	22.4452	(249)
Energy for lighting	153.5048	16.4900	25.3129	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.2208	16.4900	-76.5500	
PV Unit electricity exported	-243.8596	5.5900	-13.6318	
Total			-90.1818	(252)
Total energy cost			413.7299	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.3369	(257)
SAP value		78.3290	
SAP rating (Section 12)		78	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	292.0855	0.1601	46.7656	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2474.1578	0.1413	349.5790	(264)
Space and water heating			396.3446	(265)
Pumps, fans and electric keep-hot	136.1139	0.1387	18.8807	(267)
Energy for lighting	153.5048	0.1443	22.1555	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.2208	0.1323	-61.4360	
PV Unit electricity exported	-243.8596	0.1232	-30.0483	
Total			-91.4843	(269)
Total CO2, kg/year			345.8964	(272)
CO2 emissions per m2			5.2100	(273)
EI value			95.8397	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		66.4100 (1b)	x	2.4000 (2b)	=	159.3840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.4100						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.3840	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.8100	19.6900	25.1200	0.1400	3.5168	14.0000	351.6800	(29a)
Total net area of external elements Aum(A, m2)			44.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.8485			(33)
Party Wall 1			55.0200	0.0000	0.0000	20.0000	1100.4000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.4100			80.0000	5312.8000	(32d)
Party Ceiling 1			66.4100			80.0000	5312.8000	(32b)
Internal Wall 1			140.4500			9.0000	1264.0500	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13418.7300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.0589 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.5900	0.0700	1.1613
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	21.8000	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.5553 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	31.4038 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.0814	16.0814	15.7461	14.7402	14.5726	13.9020	13.5667	13.5667	14.2373	15.0755	15.4108	15.2432	(38)
Heat transfer coeff	47.4853	47.4853	47.1500	46.1441	45.9764	45.3058	44.9705	44.9705	45.6411	46.4794	46.8147	46.6470	(39)
Average = Sum(39)m / 12 =												46.2558	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7150	0.7150	0.7100	0.6948	0.6923	0.6822	0.6772	0.6772	0.6873	0.6999	0.7049	0.7024	(40)
HLP (average)												0.6965	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1559	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
83.0050	81.7576	79.9399	76.4620	73.8955	71.0332	69.4063	71.2103	73.1878	76.2609	79.8135	82.6870	(42a)

Hot water usage for baths

26.0831	25.6958	25.1503	24.1445	23.3913	22.5562	22.1051	22.6468	23.2366	24.1302	25.1567	25.9950	(42b)

Hot water usage for other uses

36.7088	35.3739	34.0390	32.7042	31.3693	30.0344	30.0344	31.3693	32.7042	34.0390	35.3739	36.7088	(42c)

Average daily hot water use (litres/day)	134.0826 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7969	142.8273	139.1292	133.3107	128.6561	123.6239	121.5459	125.2264	129.1285	134.4302	140.3441	145.3907	(44)
Energy conte	230.9067	203.3841	213.8364	182.4956	173.1958	152.0100	146.9993	155.0565	159.2284	182.4205	199.9459	227.6467	(45)
Energy content (annual)										Total = Sum(45)m =		2227.1258	
Distribution loss (46)m = 0.15 x (45)m	34.6360	30.5076	32.0755	27.3743	25.9794	22.8015	22.0499	23.2585	23.8843	27.3631	29.9919	34.1470	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)

Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
										Total per year (kWh/year) = Sum(64)m =		2474.1578	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	93.5611	82.7855	87.8852	76.9230	74.3722	66.7865	65.6619	68.3409	69.1866	77.4394	82.7252	92.4772	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.7302	19.3006	15.6963	11.8831	8.8827	7.4992	8.1031	10.5328	14.1371	17.9502	20.9506	22.3341	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	281.7577	284.6815	277.3137	261.6285	241.8288	223.2199	210.7880	207.8643	215.2321	230.9172	250.7169	269.3258	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	(71)
Water heating gains (Table 5)													
	125.7542	123.1928	118.1253	106.8375	99.9627	92.7591	88.2552	91.8561	96.0926	104.0853	114.8961	124.2973	(72)
Total internal gains													
	522.4518	520.3846	504.3451	473.5589	443.8841	416.6880	400.3562	403.4629	418.6715	446.1625	479.7734	509.1670	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(75)
Southeast	11.8100	33.4622	0.6300	0.8270	0.7700	142.6869	(77)

Solar gains	171.2264	321.1940	487.0707	684.6820	805.1181	796.7968	769.3033	653.9832	538.3810	359.9515	212.5016	148.7415	(83)
Total gains	693.6782	841.5786	991.4157	1158.2409	1249.0022	1213.4847	1169.6595	1057.4461	957.0525	806.1140	692.2750	657.9085	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.4964	78.4964	79.0546	80.7780	81.0725	82.2725	82.8860	82.8860	81.6681	80.1952	79.6208	79.9070	
alpha	6.2331	6.2331	6.2703	6.3852	6.4048	6.4848	6.5257	6.5257	6.4445	6.3463	6.3081	6.3271	
util living area													
	0.9197	0.8349	0.7014	0.5179	0.3787	0.2911	0.2345	0.2636	0.3905	0.6359	0.8514	0.9346	(86)
MIT	20.6348	20.8103	20.9354	20.9903	20.9988	20.9998	21.0000	20.9999	20.9989	20.9734	20.8218	20.5957	(87)
Th 2	20.3276	20.3276	20.3320	20.3454	20.3476	20.3566	20.3610	20.3610	20.3521	20.3409	20.3365	20.3387	(88)
util rest of house													
	0.9069	0.8149	0.6763	0.4930	0.3548	0.2672	0.2100	0.2365	0.3598	0.6026	0.8294	0.9237	(89)
MIT 2	19.9210	20.1249	20.2669	20.3365	20.3466	20.3564	20.3610	20.3610	20.3513	20.3170	20.1505	19.8839	(90)
Living area fraction										fLA = Living area / (4) =		0.3439	(91)
MIT	20.1665	20.3606	20.4968	20.5613	20.5709	20.5777	20.5808	20.5807	20.5740	20.5428	20.3814	20.1287	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1665	20.3606	20.4968	20.5613	20.5709	20.5777	20.5808	20.5807	20.5740	20.5428	20.3814	20.1287	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9035	0.8159	0.6826	0.5012	0.3630	0.2754	0.2184	0.2458	0.3703	0.6129	0.8309	0.9199	(94)
Useful gains	626.7471	686.6584	676.6978	580.5582	453.3870	334.1970	255.4576	259.9424	354.4406	494.0662	575.2427	605.2281	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	772.4183	762.6420	702.3835	584.2461	453.8286	334.2536	255.4673	259.9631	354.8138	503.9653	645.1697	766.3484	(97)
Space heating kWh													
	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(98a)
Space heating requirement - total per year (kWh/year)												359.1203	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												359.1203	
Space heating per m2											(98c) / (4) =	5.4076	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5604	10.4416	11.5604	11.1874	11.5604	11.1874	11.5604	11.5604	11.1874	11.5604	11.1874	11.5604	(231)
Lighting	19.0203	15.2588	13.7389	10.0657	7.7750	6.3523	7.0926	9.2193	11.9749	15.7117	17.7464	19.5489	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.4219	-24.2665	-40.8039	-53.4428	-62.3485	-58.8113	-58.3661	-51.5020	-41.7727	-29.4443	-17.0276	-12.4092	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.5668	-6.7960	-16.4400	-29.7978	-41.3079	-40.8915	-40.9673	-31.7699	-21.4298	-10.5575	-3.8409	-2.0189	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												359.1203	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2474.1578	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)													
mechanical ventilation fans (SFP = 0.7000)												136.1139	(230a)
Total electricity for the above, kWh/year												136.1139	(231)
Electricity for lighting (calculated in Appendix L)												153.5048	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-713.0011	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2409.8957	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	359.1203	25.1600	90.3547	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	25.1600	622.4981	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	136.1139	25.1600	34.2463	(249)
Energy for lighting	153.5048	25.1600	38.6218	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.6169	25.1600	-116.8976	
PV Unit electricity exported	-248.3842	5.8100	-14.4311	
Total			-131.3287	(252)
Total energy cost			654.3921	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	359.1203	0.1596	57.3260	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2474.1578	0.1413	349.5790	(264)
Space and water heating			406.9051	(265)
Pumps, fans and electric keep-hot	136.1139	0.1387	18.8807	(267)
Energy for lighting	153.5048	0.1443	22.1555	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.6169	0.1320	-61.3475	
PV Unit electricity exported	-248.3842	0.1227	-30.4782	
Total			-91.8258	(269)
Total CO2, kg/year			356.1155	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	359.1203	1.5908	571.2751	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	1.5225	3766.8228	(278)
Space and water heating			4338.0979	(279)
Pumps, fans and electric keep-hot	136.1139	1.5128	205.9132	(281)
Energy for lighting	153.5048	1.5338	235.4508	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.6169	1.4879	-691.2826	
PV Unit electricity exported	-248.3842	0.4503	-111.8546	
Total			-803.1371	(283)
Total Primary energy kWh/year			3976.3248	(286)

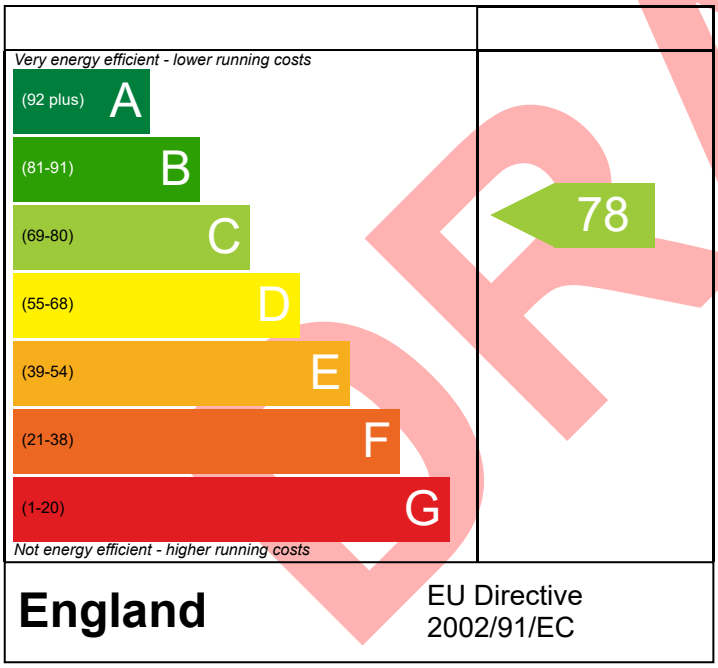
Predicted Energy Assessment

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	66.41 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

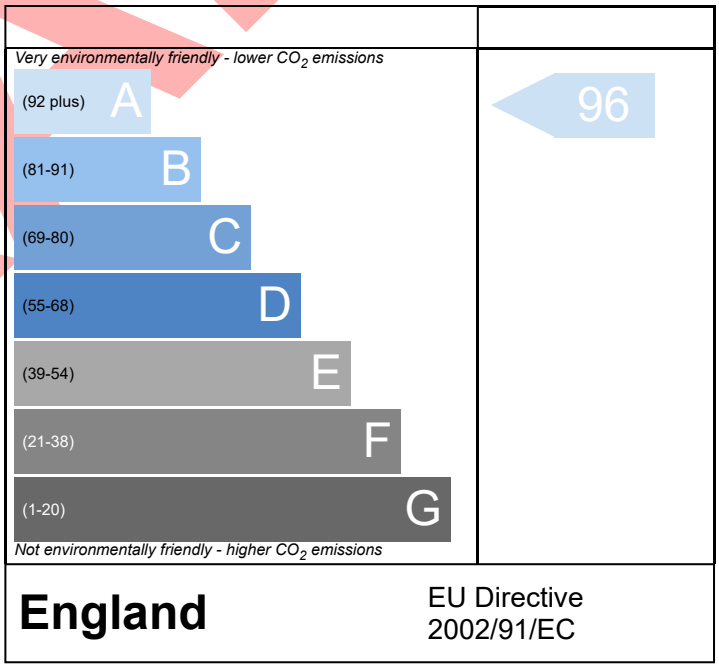
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:20

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	51 m^2
Site Reference	Unit 104 L04_Copy	Plot Reference	Unit 104 L04_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.15 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	5.41 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*60.59 kWh_{PE}/m^2*	
Dwelling primary energy	60.93 kWh_{PE}/m^2	FAIL
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*12.8 kWh/m^2*	
Dwelling fabric energy efficiency	11.8 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	8.18	0.14 **(!)**
Party wall: Party Wall (1)	46.44	0 **(!)**
Party wall: Party Wall (2)	16.06	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	7.88	South West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.66 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 104 L04_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 104 L04_Copy	**Prop Type Ref**	Unit 104 L04
Property			

SAP Rating	80 C	**DER**	5.41	**TER**	11.15
Environmental	96 A	**% DER < TER**			51.48
CO_2 Emissions (t/year)	0.28	**DFEE**	11.85	**TFEE**	12.80
Compliance Check	See BREL	**% DFEE < TFEE**			7.47
% DPER < TPER	-0.56	**DPER**	60.93	**TPER**	60.59

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.1700	(1b)	x 2.4000	(2b) =	122.8080	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.1700					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		122.8080	(5)

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2. Ventilation rate

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	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	16.0600	7.8800	8.1800	0.1400	1.1452	14.0000	114.5200	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.8828			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			16.0600	0.0000	0.0000	20.0000	321.2000	(32)
Party Floor 1			51.1700			80.0000	4093.6000	(32d)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			79.3800			9.0000	714.4200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 10266.1400	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	200.6281	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695

E4 Jamb	9.2800	0.0500	0.4640	
E7 Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.3740 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 12.2568 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.6805	11.5628	11.4450	10.8561	10.7383	10.1494	10.1494	10.0316	10.3850	10.7383	10.9739	11.2094	(38)
Heat transfer coeff	23.9374	23.8196	23.7018	23.1129	22.9951	22.4062	22.4062	22.2885	22.6418	22.9951	23.2307	23.4663	(39)
Average = Sum(39)m / 12 =												23.0835	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4678	0.4655	0.4632	0.4517	0.4494	0.4379	0.4379	0.4356	0.4425	0.4494	0.4540	0.4586	(40)
HLP (average)												0.4511	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7246 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.0608	71.9628	70.3629	67.3017	65.0426	62.5233	61.0913	62.6791	64.4197	67.1247	70.2516	72.7809	(42a)
Hot water usage for baths	22.9731	22.6319	22.1514	21.2656	20.6022	19.8667	19.4694	19.9465	20.4660	21.2530	22.1571	22.8954	(42b)
Hot water usage for other uses	32.2915	31.1172	29.9430	28.7688	27.5945	26.4203	26.4203	27.5945	28.7688	29.9430	31.1172	32.2915	(42c)
Average daily hot water use (litres/day)												118.0151	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.3253	125.7119	122.4573	117.3360	113.2393	108.8102	106.9810	110.2201	113.6544	118.3207	123.5260	127.9677	(44)
Energy conte	203.2359	179.0121	188.2123	160.6271	152.4419	133.7949	129.3842	136.4755	140.1472	160.5600	175.9854	200.3665	(45)
Energy content (annual)										Total = Sum(45)m =		1960.2433	
Distribution loss (46)m = 0.15 x (45)m	30.4854	26.8518	28.2318	24.0941	22.8663	20.0692	19.4076	20.4713	21.0221	24.0840	26.3978	30.0550	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
										Total per year (kWh/year) = Sum(64)m =		2207.2753	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	84.3606	74.6819	79.3652	69.6517	67.4716	60.7300	59.8049	62.1628	62.8422	70.1708	74.7583	83.4065	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.6375	15.6655	12.7400	9.6450	7.2098	6.0868	6.5770	8.5490	11.4745	14.5695	17.0047	18.1277	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	224.2868	226.6142	220.7492	208.2634	192.5023	177.6891	167.7930	165.4656	171.3306	183.8164	199.5774	214.3906	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	(71)
Water heating gains (Table 5)	113.3879	111.1337	106.6737	96.7385	90.6876	84.3472	80.3829	83.5521	87.2808	94.3157	103.8310	112.1055	(72)
Total internal gains	436.8760	434.9772	421.7267	396.2107	371.9635	349.6869	336.3167	339.1305	351.6496	374.2653	401.9770	426.1877	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	104.6841	178.3157	243.9793	302.3022	338.6036	336.1550	324.0893	297.0068	264.1780	197.0768	125.3874	89.5877	(83)
Total gains	541.5600	613.2928	665.7060	698.5129	710.5671	685.8419	660.4060	636.1373	615.8276	571.3421	527.3644	515.7754	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	119.1319	119.7210	120.3159	123.3815	124.0134	127.2729	127.2729	127.9454	125.9487	124.0134	122.7559	121.5237	
alpha	8.9421	8.9814	9.0211	9.2254	9.2676	9.4849	9.4849	9.5297	9.3966	9.2676	9.1837	9.1016	
util living area													
	0.7247	0.6218	0.5156	0.4003	0.3010	0.2091	0.1493	0.1612	0.2537	0.4185	0.6097	0.7476	(86)
MIT	20.9788	20.9938	20.9988	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9999	20.9959	20.9748	(87)
Th 2	20.5504	20.5526	20.5547	20.5653	20.5674	20.5781	20.5781	20.5802	20.5738	20.5674	20.5632	20.5589	(88)
util rest of house													
	0.7074	0.6052	0.4999	0.3860	0.2870	0.1953	0.1350	0.1465	0.2380	0.4011	0.5911	0.7306	(89)
MIT 2	20.5284	20.5463	20.5535	20.5652	20.5674	20.5781	20.5781	20.5802	20.5738	20.5673	20.5592	20.5326	(90)
Living area fraction										fLA = Living area / (4) =		0.5576	(91)
MIT	20.7795	20.7958	20.8017	20.8076	20.8086	20.8133	20.8133	20.8143	20.8114	20.8085	20.8027	20.7792	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7795	20.7958	20.8017	20.8076	20.8086	20.8133	20.8133	20.8143	20.8114	20.8085	20.8027	20.7792	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7163	0.6142	0.5086	0.3940	0.2948	0.2030	0.1429	0.1547	0.2468	0.4108	0.6013	0.7392	(94)
Useful gains	387.8953	376.7106	338.5994	275.1878	209.4519	139.2173	94.4049	98.3874	151.9589	234.7094	317.0931	381.2564	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	394.4762	378.6309	338.9773	275.2187	209.4537	139.2174	94.4049	98.3874	151.9591	234.7458	318.3236	389.0512	(97)
Space heating kWh													
	4.8961	1.2904	0.2812	0.0223	0.0013	0.0000	0.0000	0.0000	0.0000	0.0271	0.8860	5.7993	(98a)
Space heating requirement - total per year (kWh/year)												13.2037	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	4.8961	1.2904	0.2812	0.0223	0.0013	0.0000	0.0000	0.0000	0.0000	0.0271	0.8860	5.7993	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												13.2037	
Space heating per m2											(98c) / (4) =	0.2580	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	4.8961	1.2904	0.2812	0.0223	0.0013	0.0000	0.0000	0.0000	0.0000	0.0271	0.8860	5.7993	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	4.8961	1.2904	0.2812	0.0223	0.0013	0.0000	0.0000	0.0000	0.0000	0.0271	0.8860	5.7993	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9074	8.0454	8.9074	8.6201	8.9074	8.6201	8.9074	8.9074	8.6201	8.9074	8.6201	8.9074	(231)
Lighting	15.4380	12.3850	11.1513	8.1699	6.3107	5.1559	5.7568	7.4829	9.7196	12.7526	14.4040	15.8671	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.1420	-19.3585	-31.6479	-40.1405	-47.3610	-45.6598	-44.9395	-40.4814	-32.9522	-23.8996	-14.0606	-10.2289	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4049	-5.5792	-12.2985	-20.4286	-28.5733	-29.3630	-28.9430	-23.3991	-15.9608	-8.4088	-3.3317	-1.8477	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	13.2037	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2207.2753	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	104.8780	(230a)
Total electricity for the above, kWh/year	104.8780	(231)
Electricity for lighting (calculated in Appendix L)	124.5936	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-543.4106	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1906.5401	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	13.2037	16.4900	2.1773	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	16.4900	363.9797	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	104.8780	16.4900	17.2944	(249)
Energy for lighting	124.5936	16.4900	20.5455	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-362.8720	16.4900	-59.8376	
PV Unit electricity exported	-180.5386	5.5900	-10.0921	
Total			-69.9297	(252)
Total energy cost			334.0672	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2505	(257)
SAP value		79.7288	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	13.2037	0.1616	2.1337	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2207.2753	0.1413	311.7942	(264)
Space and water heating			313.9279	(265)
Pumps, fans and electric keep-hot	104.8780	0.1387	14.5479	(267)
Energy for lighting	124.5936	0.1443	17.9827	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-362.8720	0.1322	-47.9727	
PV Unit electricity exported	-180.5386	0.1235	-22.2897	
Total			-70.2624	(269)
Total CO2, kg/year			276.1961	(272)
CO2 emissions per m2			5.4000	(273)
EI value			96.1516	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		51.1700 (1b)	x	2.4000 (2b)	=	122.8080	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.1700						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	122.8080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	16.0600	7.8800	8.1800	0.1400	1.1452	14.0000	114.5200	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.8828			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			16.0600	0.0000	0.0000	20.0000	321.2000	(32)
Party Floor 1			51.1700			80.0000	4093.6000	(32d)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			79.3800			9.0000	714.4200	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 10266.1400 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 200.6281 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4	Jamb	9.2800	0.0500	0.4640
E7	Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165
E18	Party wall between dwellings	5.4000	0.0600	0.3240
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.3740 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 12.2568 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.7983	11.7983	11.5628	10.8561	10.7383	10.2672	10.0316	10.0316	10.5027	11.0916	11.3272	11.2094	(38)
Heat transfer coeff	24.0552	24.0552	23.8196	23.1129	22.9951	22.5240	22.2885	22.2885	22.7596	23.3485	23.5840	23.4663	(39)

Average = Sum(39)m / 12 = 23.1914

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4701	0.4701	0.4655	0.4517	0.4494	0.4402	0.4356	0.4356	0.4448	0.4563	0.4609	0.4586	(40)
HLP (average)												0.4532	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7246 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.0608	71.9628	70.3629	67.3017	65.0426	62.5233	61.0913	62.6791	64.4197	67.1247	70.2516	72.7809	(42a)
Hot water usage for baths	22.9731	22.6319	22.1514	21.2656	20.6022	19.8667	19.4694	19.9465	20.4660	21.2530	22.1571	22.8954	(42b)
Hot water usage for other uses	32.2915	31.1172	29.9430	28.7688	27.5945	26.4203	26.4203	27.5945	28.7688	29.9430	31.1172	32.2915	(42c)

Average daily hot water use (litres/day) 118.0151 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.3253	125.7119	122.4573	117.3360	113.2393	108.8102	106.9810	110.2201	113.6544	118.3207	123.5260	127.9677	(44)
Energy conte	203.2359	179.0121	188.2123	160.6271	152.4419	133.7949	129.3842	136.4755	140.1472	160.5600	175.9854	200.3665	(45)
Energy content (annual)										Total = Sum(45)m =		1960.2433	
Distribution loss (46)m = 0.15 x (45)m	30.4854	26.8518	28.2318	24.0941	22.8663	20.0692	19.4076	20.4713	21.0221	24.0840	26.3978	30.0550	(46)

Water storage loss:

Store volume 143.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)

Temperature factor from Table 2b 0.6000 (49)

Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
										Total per year (kWh/year) = Sum(64)m =		2207.2753	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	84.3606	74.6819	79.3652	69.6517	67.4716	60.7300	59.8049	62.1628	62.8422	70.1708	74.7583	83.4065	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	17.6375	15.6655	12.7400	9.6450	7.2098	6.0868	6.5770	8.5490	11.4745	14.5695	17.0047	18.1277	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	224.2868	226.6142	220.7492	208.2634	192.5023	177.6891	167.7930	165.4656	171.3306	183.8164	199.5774	214.3906	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	(71)
Water heating gains (Table 5)													
	113.3879	111.1337	106.6737	96.7385	90.6876	84.3472	80.3829	83.5521	87.2808	94.3157	103.8310	112.1055	(72)
Total internal gains													
	436.8760	434.9772	421.7267	396.2107	371.9635	349.6869	336.3167	339.1305	351.6496	374.2653	401.9770	426.1877	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(79)

Solar gains	95.2051	173.0844	247.4999	322.5774	357.6553	345.0938	336.8383	300.1802	265.5901	190.1488	117.1921	83.3220	(83)
Total gains	532.0811	608.0616	669.2266	718.7881	729.6188	694.7807	673.1549	639.3107	617.2397	564.4141	519.1691	509.5097	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	118.5486	118.5486	119.7210	123.3815	124.0134	126.6073	127.9454	127.9454	125.2970	122.1367	120.9168	121.5237	
alpha	8.9032	8.9032	8.9814	9.2254	9.2676	9.4405	9.5297	9.5297	9.3531	9.1424	9.0611	9.1016	
util living area													
	0.7538	0.6550	0.5470	0.4212	0.3246	0.2529	0.2020	0.2162	0.3024	0.4672	0.6492	0.7740	(86)
MIT	20.9702	20.9899	20.9978	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9996	20.9926	20.9661	(87)
Th 2	20.5483	20.5483	20.5526	20.5653	20.5674	20.5760	20.5802	20.5802	20.5717	20.5611	20.5568	20.5589	(88)
util rest of house													
	0.7369	0.6382	0.5313	0.4072	0.3110	0.2391	0.1881	0.2015	0.2866	0.4491	0.6302	0.7576	(89)
MIT 2	20.5170	20.5380	20.5504	20.5651	20.5674	20.5760	20.5802	20.5802	20.5717	20.5607	20.5495	20.5230	(90)
Living area fraction										fLA = Living area / (4) =		0.5576	(91)
MIT	20.7697	20.7900	20.7999	20.8075	20.8086	20.8124	20.8143	20.8143	20.8105	20.8054	20.7965	20.7701	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7697	20.7900	20.7999	20.8075	20.8086	20.8124	20.8143	20.8143	20.8105	20.8054	20.7965	20.7701	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7453	0.6472	0.5400	0.4150	0.3186	0.2468	0.1958	0.2097	0.2954	0.4592	0.6405	0.7655	(94)
Useful gains	396.5380	393.5486	361.3857	298.2777	232.4448	171.4613	131.8200	134.0489	182.3141	259.1802	332.5508	390.0548	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	405.8027	396.6690	362.0545	298.3300	232.4487	171.4615	131.8201	134.0489	182.3155	259.2946	334.8115	400.5712	(97)
Space heating kWh													
	6.8930	2.0969	0.4976	0.0377	0.0029	0.0000	0.0000	0.0000	0.0000	0.0851	1.6276	7.8241	(98a)
Space heating requirement - total per year (kWh/year)												19.0650	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	6.8930	2.0969	0.4976	0.0377	0.0029	0.0000	0.0000	0.0000	0.0000	0.0851	1.6276	7.8241	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												19.0650	
Space heating per m2										(98c) / (4) =		0.3726	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	6.8930	2.0969	0.4976	0.0377	0.0029	0.0000	0.0000	0.0000	0.0000	0.0851	1.6276	7.8241	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	6.8930	2.0969	0.4976	0.0377	0.0029	0.0000	0.0000	0.0000	0.0000	0.0851	1.6276	7.8241	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9074	8.0454	8.9074	8.6201	8.9074	8.6201	8.9074	8.9074	8.6201	8.9074	8.6201	8.9074	(231)

Lighting	15.4380	12.3850	11.1513	8.1699	6.3107	5.1559	5.7568	7.4829	9.7196	12.7526	14.4040	15.8671	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.9944	-18.6173	-31.6417	-41.8588	-49.0561	-46.3351	-45.9986	-40.4939	-32.7321	-22.8868	-13.0643	-9.4500	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.0435	-5.2214	-12.2897	-22.0235	-30.4942	-30.1810	-30.2340	-23.4124	-15.7721	-7.8122	-2.9511	-1.6227	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	19.0650	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2207.2753	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	104.8780	(230a)
Total electricity for the above, kWh/year	104.8780	(231)
Electricity for lighting (calculated in Appendix L)	124.5936	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-547.1869	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1908.6251	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	19.0650	25.1600	4.7968	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	25.1600	555.3505	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	104.8780	25.1600	26.3873	(249)
Energy for lighting	124.5936	25.1600	31.3478	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1291	25.1600	-91.3633	
PV Unit electricity exported	-184.0578	5.8100	-10.6938	
Total			-102.0570	(252)
Total energy cost			515.8253	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	19.0650	0.1612	3.0737	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2207.2753	0.1413	311.7942	(264)
Space and water heating			314.8679	(265)
Pumps, fans and electric keep-hot	104.8780	0.1387	14.5479	(267)
Energy for lighting	124.5936	0.1443	17.9827	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1291	0.1319	-47.8936	
PV Unit electricity exported	-184.0578	0.1230	-22.6361	
Total			-70.5297	(269)
Total CO2, kg/year			276.8688	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	19.0650	1.5966	30.4390	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	1.5223	3360.2168	(278)
Space and water heating			3390.6558	(279)
Pumps, fans and electric keep-hot	104.8780	1.5128	158.6595	(281)
Energy for lighting	124.5936	1.5338	191.1059	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1291	1.4873	-540.0823	
PV Unit electricity exported	-184.0578	0.4513	-83.0740	
Total			-623.1563	(283)
Total Primary energy kWh/year			3117.2649	(286)

SAP 10 EPC IMPROVEMENTS

Unit 104 L04_Copy

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 80
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£618	£618	£0
Space heating	£31	£31	£0
Water heating	£555	£555	£0
Lighting	£31	£31	£0
Generated (PV)	-£102	-£102	£0
Total cost of fuels	£516	£516	£0
Total cost of uses	£515	£515	£0
Delivered energy	37 kWh/m²	37 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	61 kWh/m²	61 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.1700 (1b)	x	2.4000 (2b)	=	122.8080	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.1700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	122.8080	(5)

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2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	16.0600	7.8800	8.1800	0.1400	1.1452	14.0000	114.5200	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.8828			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			16.0600	0.0000	0.0000	20.0000	321.2000	(32)
Party Floor 1			51.1700			80.0000	4093.6000	(32d)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			79.3800			9.0000	714.4200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10266.1400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		200.6281 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.3740 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	12.2568 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.6805	11.5628	11.4450	10.8561	10.7383	10.1494	10.1494	10.0316	10.3850	10.7383	10.9739	11.2094	(38)
Heat transfer coeff	23.9374	23.8196	23.7018	23.1129	22.9951	22.4062	22.4062	22.2885	22.6418	22.9951	23.2307	23.4663	(39)
Average = Sum(39)m / 12 =												23.0835	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4678	0.4655	0.4632	0.4517	0.4494	0.4379	0.4379	0.4356	0.4425	0.4494	0.4540	0.4586	(40)
HLP (average)												0.4511	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.7246 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.0608	71.9628	70.3629	67.3017	65.0426	62.5233	61.0913	62.6791	64.4197	67.1247	70.2516	72.7809	(42a)

Hot water usage for baths

22.9731	22.6319	22.1514	21.2656	20.6022	19.8667	19.4694	19.9465	20.4660	21.2530	22.1571	22.8954	(42b)

Hot water usage for other uses

32.2915	31.1172	29.9430	28.7688	27.5945	26.4203	26.4203	27.5945	28.7688	29.9430	31.1172	32.2915	(42c)

Average daily hot water use (litres/day)		118.0151 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.3253	125.7119	122.4573	117.3360	113.2393	108.8102	106.9810	110.2201	113.6544	118.3207	123.5260	127.9677	(44)
Energy conte	203.2359	179.0121	188.2123	160.6271	152.4419	133.7949	129.3842	136.4755	140.1472	160.5600	175.9854	200.3665	(45)
Energy content (annual)										Total = Sum(45)m =		1960.2433	

Distribution loss (46)m = 0.15 x (45)m

30.4854	26.8518	28.2318	24.0941	22.8663	20.0692	19.4076	20.4713	21.0221	24.0840	26.3978	30.0550	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)

	Total per year (kWh/year) = Sum(64)m =	2207.2753 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000 (64a)

Heat gains from water heating, kWh/month

84.3606	74.6819	79.3652	69.6517	67.4716	60.7300	59.8049	62.1628	62.8422	70.1708	74.7583	83.4065	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.6375	15.6655	12.7400	9.6450	7.2098	6.0868	6.5770	8.5490	11.4745	14.5695	17.0047	18.1277	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	224.2868	226.6142	220.7492	208.2634	192.5023	177.6891	167.7930	165.4656	171.3306	183.8164	199.5774	214.3906	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	(71)
Water heating gains (Table 5)	113.3879	111.1337	106.6737	96.7385	90.6876	84.3472	80.3829	83.5521	87.2808	94.3157	103.8310	112.1055	(72)
Total internal gains	436.8760	434.9772	421.7267	396.2107	371.9635	349.6869	336.3167	339.1305	351.6496	374.2653	401.9770	426.1877	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(79)

Solar gains	104.6841	178.3157	243.9793	302.3022	338.6036	336.1550	324.0893	297.0068	264.1780	197.0768	125.3874	89.5877 (83)
Total gains	541.5600	613.2928	665.7060	698.5129	710.5671	685.8419	660.4060	636.1373	615.8276	571.3421	527.3644	515.7754 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	119.1319	119.7210	120.3159	123.3815	124.0134	127.2729	127.2729	127.9454	125.9487	124.0134	122.7559	121.5237	
alpha	8.9421	8.9814	9.0211	9.2254	9.2676	9.4849	9.4849	9.5297	9.3966	9.2676	9.1837	9.1016	
util living area	0.7247	0.6218	0.5156	0.4003	0.3010	0.2091	0.1493	0.1612	0.2537	0.4185	0.6097	0.7476	(86)
MIT	20.9788	20.9938	20.9988	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9999	20.9959	20.9748	(87)
Th 2	20.5504	20.5526	20.5547	20.5653	20.5674	20.5781	20.5781	20.5802	20.5738	20.5674	20.5632	20.5589	(88)
util rest of house	0.7074	0.6052	0.4999	0.3860	0.2870	0.1953	0.1350	0.1465	0.2380	0.4011	0.5911	0.7306	(89)
MIT 2	20.5284	20.5463	20.5535	20.5652	20.5674	20.5781	20.5781	20.5802	20.5738	20.5673	20.5592	20.5326	(90)
Living area fraction									fLA = Living area / (4) =			0.5576	(91)
MIT	20.7795	20.7958	20.8017	20.8076	20.8086	20.8133	20.8133	20.8143	20.8114	20.8085	20.8027	20.7792	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7795	20.7958	20.8017	20.8076	20.8086	20.8133	20.8133	20.8143	20.8114	20.8085	20.8027	20.7792	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7163	0.6142	0.5086	0.3940	0.2948	0.2030	0.1429	0.1547	0.2468	0.4108	0.6013	0.7392	(94)
Useful gains	387.8953	376.7106	338.5994	275.1878	209.4519	139.2173	94.4049	98.3874	151.9589	234.7094	317.0931	381.2564	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	394.4762	378.6309	338.9773	275.2187	209.4537	139.2174	94.4049	98.3874	151.9591	234.7458	318.3236	389.0512	(97)
Space heating kWh	4.8961	1.2904	0.2812	0.0223	0.0013	0.0000	0.0000	0.0000	0.0000	0.0271	0.8860	5.7993	(98a)
Space heating requirement - total per year (kWh/year)												13.2037	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	4.8961	1.2904	0.2812	0.0223	0.0013	0.0000	0.0000	0.0000	0.0000	0.0271	0.8860	5.7993	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												13.2037	
Space heating per m2											(98c) / (4) =	0.2580	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	4.8961	1.2904	0.2812	0.0223	0.0013	0.0000	0.0000	0.0000	0.0000	0.0271	0.8860	5.7993	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	4.8961	1.2904	0.2812	0.0223	0.0013	0.0000	0.0000	0.0000	0.0000	0.0271	0.8860	5.7993	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9074	8.0454	8.9074	8.6201	8.9074	8.6201	8.9074	8.9074	8.6201	8.9074	8.6201	8.9074	(231)
Lighting	15.4380	12.3850	11.1513	8.1699	6.3107	5.1559	5.7568	7.4829	9.7196	12.7526	14.4040	15.8671	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.1420	-19.3585	-31.6479	-40.1405	-47.3610	-45.6598	-44.9395	-40.4814	-32.9522	-23.8996	-14.0606	-10.2289	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4049	-5.5792	-12.2985	-20.4286	-28.5733	-29.3630	-28.9430	-23.3991	-15.9608	-8.4088	-3.3317	-1.8477	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												13.2037	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2207.2753	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	104.8780	(230a)
Total electricity for the above, kWh/year	104.8780	(231)
Electricity for lighting (calculated in Appendix L)	124.5936	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-543.4106	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1906.5401	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	13.2037	16.4900	2.1773	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	16.4900	363.9797	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	104.8780	16.4900	17.2944	(249)
Energy for lighting	124.5936	16.4900	20.5455	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-362.8720	16.4900	-59.8376	
PV Unit electricity exported	-180.5386	5.5900	-10.0921	
Total			-69.9297	(252)
Total energy cost			334.0672	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2505	(257)
SAP value		79.7288	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	13.2037	0.1616	2.1337	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2207.2753	0.1413	311.7942	(264)
Space and water heating			313.9279	(265)
Pumps, fans and electric keep-hot	104.8780	0.1387	14.5479	(267)
Energy for lighting	124.5936	0.1443	17.9827	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-362.8720	0.1322	-47.9727	
PV Unit electricity exported	-180.5386	0.1235	-22.2897	
Total			-70.2624	(269)
Total CO2, kg/year			276.1961	(272)
CO2 emissions per m2			5.4000	(273)
EI value			96.1516	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		51.1700	(1b)	x 2.4000	(2b) =	122.8080	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.1700						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		122.8080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	16.0600	7.8800	8.1800	0.1400	1.1452	14.0000	114.5200	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	10.8828			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			16.0600	0.0000	0.0000	20.0000	321.2000	(32)
Party Floor 1			51.1700			80.0000	4093.6000	(32d)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			79.3800			9.0000	714.4200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 10266.1400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	200.6281 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	1.3740 (36)
Point Thermal bridges (36a) =	0.0000
Total fabric heat loss (33) + (36) + (36a) =	12.2568 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.7983	11.7983	11.5628	10.8561	10.7383	10.2672	10.0316	10.0316	10.5027	11.0916	11.3272	11.2094	(38)
Heat transfer coeff	24.0552	24.0552	23.8196	23.1129	22.9951	22.5240	22.2885	22.2885	22.7596	23.3485	23.5840	23.4663	(39)
Average = Sum(39)m / 12 =												23.1914	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4701	0.4701	0.4655	0.4517	0.4494	0.4402	0.4356	0.4356	0.4448	0.4563	0.4609	0.4586	(40)
HLP (average)												0.4532	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7246 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.0608	71.9628	70.3629	67.3017	65.0426	62.5233	61.0913	62.6791	64.4197	67.1247	70.2516	72.7809	(42a)
Hot water usage for baths	22.9731	22.6319	22.1514	21.2656	20.6022	19.8667	19.4694	19.9465	20.4660	21.2530	22.1571	22.8954	(42b)
Hot water usage for other uses	32.2915	31.1172	29.9430	28.7688	27.5945	26.4203	26.4203	27.5945	28.7688	29.9430	31.1172	32.2915	(42c)
Average daily hot water use (litres/day)												118.0151	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.3253	125.7119	122.4573	117.3360	113.2393	108.8102	106.9810	110.2201	113.6544	118.3207	123.5260	127.9677	(44)
Energy conte	203.2359	179.0121	188.2123	160.6271	152.4419	133.7949	129.3842	136.4755	140.1472	160.5600	175.9854	200.3665	(45)
Energy content (annual)										Total = Sum(45)m =		1960.2433	
Distribution loss (46)m = 0.15 x (45)m	30.4854	26.8518	28.2318	24.0941	22.8663	20.0692	19.4076	20.4713	21.0221	24.0840	26.3978	30.0550	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
									Total per year (kWh/year) = Sum(64)m =			2207.2753	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	84.3606	74.6819	79.3652	69.6517	67.4716	60.7300	59.8049	62.1628	62.8422	70.1708	74.7583	83.4065	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.6375	15.6655	12.7400	9.6450	7.2098	6.0868	6.5770	8.5490	11.4745	14.5695	17.0047	18.1277	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	224.2868	226.6142	220.7492	208.2634	192.5023	177.6891	167.7930	165.4656	171.3306	183.8164	199.5774	214.3906	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	(71)
Water heating gains (Table 5)	113.3879	111.1337	106.6737	96.7385	90.6876	84.3472	80.3829	83.5521	87.2808	94.3157	103.8310	112.1055	(72)
Total internal gains	436.8760	434.9772	421.7267	396.2107	371.9635	349.6869	336.3167	339.1305	351.6496	374.2653	401.9770	426.1877	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(79)

Solar gains	95.2051	173.0844	247.4999	322.5774	357.6553	345.0938	336.8383	300.1802	265.5901	190.1488	117.1921	83.3220	(83)
Total gains	532.0811	608.0616	669.2266	718.7881	729.6188	694.7807	673.1549	639.3107	617.2397	564.4141	519.1691	509.5097	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	118.5486	118.5486	119.7210	123.3815	124.0134	126.6073	127.9454	127.9454	125.2970	122.1367	120.9168	121.5237	
alpha	8.9032	8.9032	8.9814	9.2254	9.2676	9.4405	9.5297	9.5297	9.3531	9.1424	9.0611	9.1016	
util living area	0.7538	0.6550	0.5470	0.4212	0.3246	0.2529	0.2020	0.2162	0.3024	0.4672	0.6492	0.7740	(86)
MIT	20.9702	20.9899	20.9978	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9996	20.9926	20.9661	(87)
Th 2	20.5483	20.5483	20.5526	20.5653	20.5674	20.5760	20.5802	20.5802	20.5717	20.5611	20.5568	20.5589	(88)
util rest of house	0.7369	0.6382	0.5313	0.4072	0.3110	0.2391	0.1881	0.2015	0.2866	0.4491	0.6302	0.7576	(89)
MIT 2	20.5170	20.5380	20.5504	20.5651	20.5674	20.5760	20.5802	20.5802	20.5717	20.5607	20.5495	20.5230	(90)
Living area fraction										fLA = Living area / (4) =		0.5576	(91)
MIT	20.7697	20.7900	20.7999	20.8075	20.8086	20.8124	20.8143	20.8143	20.8105	20.8054	20.7965	20.7701	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7697	20.7900	20.7999	20.8075	20.8086	20.8124	20.8143	20.8143	20.8105	20.8054	20.7965	20.7701	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7453	0.6472	0.5400	0.4150	0.3186	0.2468	0.1958	0.2097	0.2954	0.4592	0.6405	0.7655	(94)
Useful gains	396.5380	393.5486	361.3857	298.2777	232.4448	171.4613	131.8200	134.0489	182.3141	259.1802	332.5508	390.0548	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	405.8027	396.6690	362.0545	298.3300	232.4487	171.4615	131.8201	134.0489	182.3155	259.2946	334.8115	400.5712	(97)
Space heating kWh	6.8930	2.0969	0.4976	0.0377	0.0029	0.0000	0.0000	0.0000	0.0000	0.0851	1.6276	7.8241	(98a)
Space heating requirement - total per year (kWh/year)												19.0650	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	6.8930	2.0969	0.4976	0.0377	0.0029	0.0000	0.0000	0.0000	0.0000	0.0851	1.6276	7.8241	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												19.0650	
Space heating per m2											(98c) / (4) =	0.3726	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	6.8930	2.0969	0.4976	0.0377	0.0029	0.0000	0.0000	0.0000	0.0000	0.0851	1.6276	7.8241	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													

	6.8930	2.0969	0.4976	0.0377	0.0029	0.0000	0.0000	0.0000	0.0000	0.0851	1.6276	7.8241 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	8.9074	8.0454	8.9074	8.6201	8.9074	8.6201	8.9074	8.9074	8.6201	8.9074	8.6201	8.9074 (231)
Lighting	15.4380	12.3850	11.1513	8.1699	6.3107	5.1559	5.7568	7.4829	9.7196	12.7526	14.4040	15.8671 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-10.9944	-18.6173	-31.6417	-41.8588	-49.0561	-46.3351	-45.9986	-40.4939	-32.7321	-22.8868	-13.0643	-9.4500 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.0435	-5.2214	-12.2897	-22.0235	-30.4942	-30.1810	-30.2340	-23.4124	-15.7721	-7.8122	-2.9511	-1.6227 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	19.0650 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2207.2753 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	104.8780 (230a)
Total electricity for the above, kWh/year	104.8780 (231)
Electricity for lighting (calculated in Appendix L)	124.5936 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-547.1869 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1908.6251 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	19.0650	25.1600	4.7968	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	25.1600	555.3505	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	104.8780	25.1600	26.3873	(249)
Energy for lighting	124.5936	25.1600	31.3478	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1291	25.1600	-91.3633	
PV Unit electricity exported	-184.0578	5.8100	-10.6938	
Total			-102.0570	(252)
Total energy cost			515.8253	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	19.0650	0.1612	3.0737	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2207.2753	0.1413	311.7942	(264)
Space and water heating			314.8679	(265)
Pumps, fans and electric keep-hot	104.8780	0.1387	14.5479	(267)
Energy for lighting	124.5936	0.1443	17.9827	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1291	0.1319	-47.8936	
PV Unit electricity exported	-184.0578	0.1230	-22.6361	
Total			-70.5297	(269)
Total CO2, kg/year			276.8688	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	19.0650	1.5966	30.4390	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	1.5223	3360.2168	(278)
Space and water heating			3390.6558	(279)

Pumps, fans and electric keep-hot	104.8780	1.5128	158.6595 (281)
Energy for lighting	124.5936	1.5338	191.1059 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-363.1291	1.4873	-540.0823
PV Unit electricity exported	-184.0578	0.4513	-83.0740
Total			-623.1563 (283)
Total Primary energy kWh/year			3117.2649 (286)

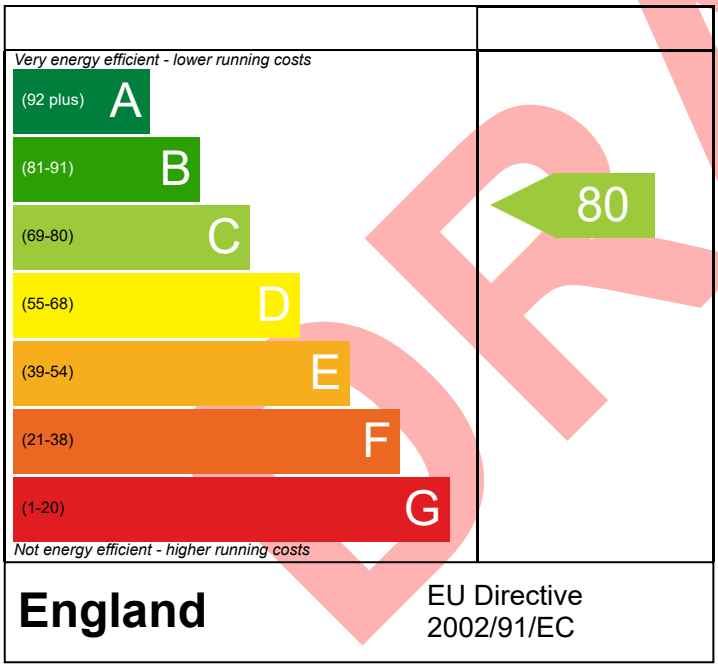
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	51.17 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

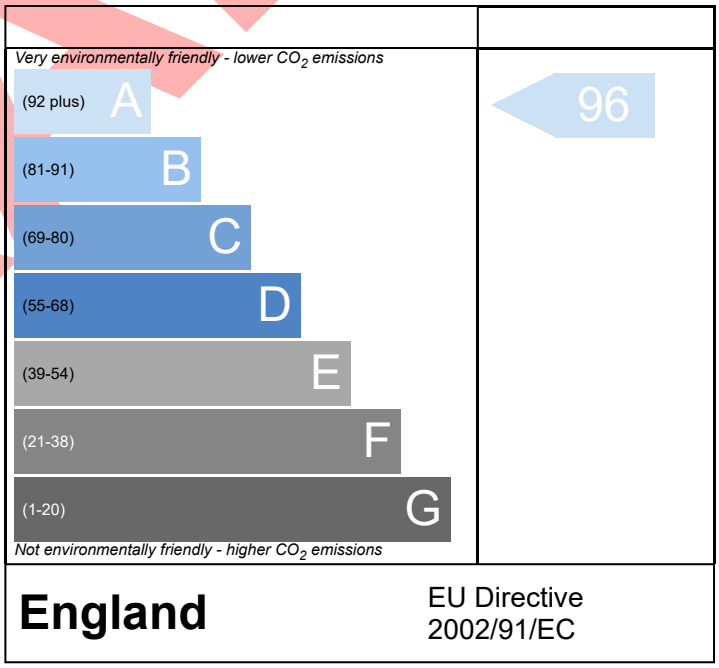
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:20

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	78 m^2
Site Reference	Unit 120 L06_Copy	Plot Reference	Unit 120 L06_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*9.2 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	4.18 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*49.68 kWh$_{PE}$/m^2*	
Dwelling primary energy	47.84 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*14.3 kWh/m^2*	
Dwelling fabric energy efficiency	13.0 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	16.87	0.14 **(!)**
Party wall: Party Wall (1)	23.22	0 **(!)**
Party wall: Party Wall (2)	49.27	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	10.77	South West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	1.01 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 120 L06_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 120 L06_Copy	**Prop Type Ref**	Unit 120 L06
Property			

SAP Rating	81 B	**DER**	4.18	**TER**	9.20
Environmental	96 A	**% DER < TER**			54.57
CO_2 Emissions (t/year)	0.33	**DFEE**	13.00	**TFEE**	14.32
Compliance Check	See BREL	**% DFEE < TFEE**			9.19
% DPER < TPER	3.71	**DPER**	47.84	**TPER**	49.68

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	77.8100 (1b)	x	2.4000 (2b)	=	186.7440	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.8100					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	186.7440	(5)

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2. Ventilation rate
---

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.7700	1.2357	13.3089			(27)
External Wall 1	27.6400	10.7700	16.8700	0.1400	2.3618	14.0000	236.1800	(29a)
Total net area of external elements Aum(A, m2)			27.6400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		15.6707			(33)
Party Wall 1			23.2200	0.0000	0.0000	20.0000	464.4000	(32)
Wall to corridor			49.2700	0.0000	0.0000	20.0000	985.4000	(32)
Party Floor 1			77.8100			80.0000	6224.8000	(32d)
Party Ceiling 1			77.8100			80.0000	6224.8000	(32b)
Internal Wall 1			131.3800			9.0000	1182.4200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	15318.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		196.8642 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	4.6400	0.0500	0.2320

E4 Jamb	27.8400	0.0500	1.3920	
E7 Party floor between dwellings (in blocks of flats)	19.2200	0.0700	1.3454	
E18 Party wall between dwellings	2.7000	0.0600	0.1620	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	53.7000	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.1314 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 18.8021 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	17.7616	17.5825	17.4034	16.5079	16.3288	15.4333	15.4333	15.2542	15.7915	16.3288	16.6870	17.0452	(38)
Heat transfer coeff													
	36.5638	36.3847	36.2056	35.3101	35.1310	34.2355	34.2355	34.0564	34.5937	35.1310	35.4892	35.8474	(39)

Average = Sum(39)m / 12 = 35.2653

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4699	0.4676	0.4653	0.4538	0.4515	0.4400	0.4400	0.4377	0.4446	0.4515	0.4561	0.4607	(40)
HLP (average)												0.4532	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.4200 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers													
	89.0932	87.7543	85.8032	82.0703	79.3155	76.2433	74.4971	76.4334	78.5559	81.8544	85.6676	88.7518	(42a)
Hot water usage for baths													
	27.9872	27.5716	26.9862	25.9070	25.0989	24.2028	23.7188	24.3000	24.9329	25.8917	26.9932	27.8926	(42b)
Hot water usage for other uses													
	39.4132	37.9800	36.5467	35.1135	33.6803	32.2471	32.2471	33.6803	35.1135	36.5467	37.9800	39.4132	(42c)

Average daily hot water use (litres/day) 143.9196 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	156.4935	153.3058	149.3362	143.0908	138.0947	132.6933	130.4630	134.4137	138.6023	144.2929	150.6407	156.0576	(44)
Energy conte	247.8475	218.3054	229.5242	195.8842	185.9020	163.1619	157.7837	166.4323	170.9105	195.8041	214.6153	244.3485	(45)
Energy content (annual)										Total = Sum(45)m =		2390.5196	
Distribution loss (46)m = 0.15 x (45)m													
	37.1771	32.7458	34.4286	29.3826	27.8853	24.4743	23.6676	24.9648	25.6366	29.3706	32.1923	36.6523	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	268.8283	237.2558	250.5050	216.1882	206.8828	183.4659	178.7645	187.4131	191.2145	216.7849	234.9193	265.3293	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	268.8283	237.2558	250.5050	216.1882	206.8828	183.4659	178.7645	187.4131	191.2145	216.7849	234.9193	265.3293	(64)
										Total per year (kWh/year) = Sum(64)m =		2637.5516	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	99.1939	87.7469	93.1014	81.3747	78.5971	70.4945	69.2477	72.1234	73.0709	81.8895	87.6028	98.0305	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.1996	145.1996	145.1996	145.1996	145.1996	145.1996	145.1996	145.1996	145.1996	145.1996	145.1996	145.1996	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.6868	22.8148	18.5542	14.0468	10.5001	8.8646	9.5786	12.4506	16.7111	21.2186	24.7653	26.4007	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	320.6010	323.9278	315.5443	297.6968	275.1675	253.9931	239.8474	236.5205	244.9041	262.7516	285.2808	306.4552	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.9400	51.9400	51.9400	51.9400	51.9400	51.9400	51.9400	51.9400	51.9400	51.9400	51.9400	51.9400	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-96.7998	-96.7998	-96.7998	-96.7998	-96.7998	-96.7998	-96.7998	-96.7998	-96.7998	-96.7998	-96.7998	-96.7998	(71)
Water heating gains (Table 5)													
	133.3252	130.5757	125.1363	113.0204	105.6412	97.9090	93.0749	96.9400	101.4874	110.0665	121.6705	131.7614	(72)
Total internal gains													
	579.9528	577.6581	559.5747	525.1038	491.6486	461.1067	442.8407	446.2510	463.4424	494.3766	532.0565	564.9572	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	10.7700	36.7938	0.6300	0.8270	0.7700	143.0771	(79)

Solar gains	143.0771	243.7132	333.4590	413.1719	462.7869	459.4403	442.9495	405.9344	361.0656	269.3550	171.3733	122.4442	(83)
Total gains	723.0299	821.3713	893.0337	938.2756	954.4356	920.5469	885.7901	852.1854	824.5080	763.7315	703.4298	687.4013	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	116.3720	116.9449	117.5234	120.5039	121.1182	124.2863	124.2863	124.9399	122.9994	121.1182	119.8957	118.6977	
alpha	8.7581	8.7963	8.8349	9.0336	9.0745	9.2858	9.2858	9.3293	9.2000	9.0745	8.9930	8.9132	
util living area	0.8075	0.7023	0.5856	0.4552	0.3423	0.2380	0.1701	0.1838	0.2895	0.4781	0.6924	0.8304	(86)
MIT	20.9479	20.9826	20.9961	20.9996	21.0000	21.0000	21.0000	21.0000	21.0000	20.9995	20.9878	20.9387	(87)
Th 2	20.5485	20.5506	20.5527	20.5634	20.5655	20.5761	20.5761	20.5783	20.5719	20.5655	20.5612	20.5570	(88)
util rest of house	0.7909	0.6846	0.5680	0.4388	0.3263	0.2223	0.1537	0.1670	0.2715	0.4582	0.6723	0.8147	(89)
MIT 2	20.4930	20.5327	20.5489	20.5630	20.5655	20.5761	20.5761	20.5783	20.5719	20.5651	20.5491	20.4911	(90)
Living area fraction										fLA = Living area / (4) =		0.4366	(91)
MIT	20.6916	20.7291	20.7442	20.7536	20.7552	20.7612	20.7612	20.7624	20.7588	20.7548	20.7407	20.6865	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6916	20.7291	20.7442	20.7536	20.7552	20.7612	20.7612	20.7624	20.7588	20.7548	20.7407	20.6865	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7963	0.6917	0.5756	0.4459	0.3333	0.2291	0.1608	0.1743	0.2794	0.4669	0.6806	0.8194	(94)
Useful gains	575.7300	568.1162	514.0059	418.3948	318.1068	210.9311	142.4603	148.5672	230.3505	356.5563	478.7274	563.2356	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	599.3386	575.9383	515.7179	418.5526	318.1167	210.9312	142.4603	148.5673	230.3518	356.7466	484.0957	590.9978	(97)
Space heating kWh	17.5648	5.2564	1.2737	0.1137	0.0074	0.0000	0.0000	0.0000	0.0000	0.1415	3.8652	20.6551	(98a)
Space heating requirement - total per year (kWh/year)												48.8778	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	17.5648	5.2564	1.2737	0.1137	0.0074	0.0000	0.0000	0.0000	0.0000	0.1415	3.8652	20.6551	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												48.8778	
Space heating per m2										(98c) / (4) =		0.6282	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	17.5648	5.2564	1.2737	0.1137	0.0074	0.0000	0.0000	0.0000	0.0000	0.1415	3.8652	20.6551	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	17.5648	5.2564	1.2737	0.1137	0.0074	0.0000	0.0000	0.0000	0.0000	0.1415	3.8652	20.6551	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	268.8283	237.2558	250.5050	216.1882	206.8828	183.4659	178.7645	187.4131	191.2145	216.7849	234.9193	265.3293	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	268.8283	237.2558	250.5050	216.1882	206.8828	183.4659	178.7645	187.4131	191.2145	216.7849	234.9193	265.3293	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	14.3575	12.9681	14.3575	13.8944	14.3575	13.8944	14.3575	14.3575	13.8944	14.3575	13.8944	14.3575	(231)
Lighting	22.4835	18.0371	16.2404	11.8984	9.1907	7.5089	8.3841	10.8979	14.1553	18.5725	20.9776	23.1084	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-18.3305	-29.0186	-47.1029	-59.3107	-69.5891	-66.9307	-65.8641	-59.5224	-48.7201	-35.6313	-21.1381	-15.4631	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.9307	-9.1438	-20.1484	-33.3783	-46.6132	-47.8770	-47.1985	-38.2342	-26.1316	-13.8104	-5.4774	-3.0178	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	48.8778	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2637.5516	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	169.0481	(230a)
Total electricity for the above, kWh/year	169.0481	(231)
Electricity for lighting (calculated in Appendix L)	181.4549	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-831.5829	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2205.3496	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	48.8778	16.4900	8.0600	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2637.5516	16.4900	434.9323	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	169.0481	16.4900	27.8760	(249)
Energy for lighting	181.4549	16.4900	29.9219	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-536.6215	16.4900	-88.4889	
PV Unit electricity exported	-294.9613	5.5900	-16.4883	
Total			-104.9772	(252)
Total energy cost			395.8129	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1603	(257)
SAP value		81.1920	
SAP rating (Section 12)		81	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	48.8778	0.1613	7.8859	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2637.5516	0.1413	372.7121	(264)
Space and water heating			380.5980	(265)
Pumps, fans and electric keep-hot	169.0481	0.1387	23.4491	(267)
Energy for lighting	181.4549	0.1443	26.1896	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-536.6215	0.1323	-71.0159	
PV Unit electricity exported	-294.9613	0.1235	-36.4272	
Total			-107.4431	(269)
Total CO2, kg/year			322.7934	(272)
CO2 emissions per m2			4.1500	(273)
EI value			96.4779	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		77.8100 (1b)	x	2.4000 (2b)	=	186.7440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.8100						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	186.7440	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.7700	1.2357	13.3089			(27)
External Wall 1	27.6400	10.7700	16.8700	0.1400	2.3618	14.0000	236.1800	(29a)
Total net area of external elements Aum(A, m2)			27.6400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	15.6707			(33)
Party Wall 1			23.2200	0.0000	0.0000	20.0000	464.4000	(32)
Wall to corridor			49.2700	0.0000	0.0000	20.0000	985.4000	(32)
Party Floor 1			77.8100			80.0000	6224.8000	(32d)
Party Ceiling 1			77.8100			80.0000	6224.8000	(32b)
Internal Wall 1			131.3800			9.0000	1182.4200	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 15318.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 196.8642 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	4.6400	0.0500	0.2320
E4 Jamb	27.8400	0.0500	1.3920
E7 Party floor between dwellings (in blocks of flats)	19.2200	0.0700	1.3454
E18 Party wall between dwellings	2.7000	0.0600	0.1620
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	53.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.1314 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 18.8021 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	17.9407	17.9407	17.5825	16.5079	16.3288	15.6124	15.2542	15.2542	15.9706	16.8661	17.2243	17.0452	(38)
Heat transfer coeff	36.7429	36.7429	36.3847	35.3101	35.1310	34.4146	34.0564	34.0564	34.7728	35.6683	36.0265	35.8474	(39)

Average = Sum(39)m / 12 = 35.4295

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4722	0.4722	0.4676	0.4538	0.4515	0.4423	0.4377	0.4377	0.4469	0.4584	0.4630	0.4607	(40)
HLP (average)												0.4553	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.4200 (42)
Hot water usage for mixer showers

89.0932	87.7543	85.8032	82.0703	79.3155	76.2433	74.4971	76.4334	78.5559	81.8544	85.6676	88.7518	(42a)

Hot water usage for baths

27.9872	27.5716	26.9862	25.9070	25.0989	24.2028	23.7188	24.3000	24.9329	25.8917	26.9932	27.8926	(42b)

Hot water usage for other uses

39.4132	37.9800	36.5467	35.1135	33.6803	32.2471	32.2471	33.6803	35.1135	36.5467	37.9800	39.4132	(42c)

Average daily hot water use (litres/day) 143.9196 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	156.4935	153.3058	149.3362	143.0908	138.0947	132.6933	130.4630	134.4137	138.6023	144.2929	150.6407	156.0576	(44)
Energy conte	247.8475	218.3054	229.5242	195.8842	185.9020	163.1619	157.7837	166.4323	170.9105	195.8041	214.6153	244.3485	(45)

Energy content (annual) Total = Sum(45)m = 2390.5196
Distribution loss (46)m = 0.15 x (45)m

37.1771	32.7458	34.4286	29.3826	27.8853	24.4743	23.6676	24.9648	25.6366	29.3706	32.1923	36.6523	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

268.8283	237.2558	250.5050	216.1882	206.8828	183.4659	178.7645	187.4131	191.2145	216.7849	234.9193	265.3293	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

268.8283	237.2558	250.5050	216.1882	206.8828	183.4659	178.7645	187.4131	191.2145	216.7849	234.9193	265.3293	(64)

Total per year (kWh/year) = Sum(64)m = 2637.5516 (64)
Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month

99.1939	87.7469	93.1014	81.3747	78.5971	70.4945	69.2477	72.1234	73.0709	81.8895	87.6028	98.0305	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	145.1996	145.1996	145.1996	145.1996	145.1996	145.1996	145.1996	145.1996	145.1996	145.1996	145.1996	145.1996	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.6868	22.8148	18.5542	14.0468	10.5001	8.8646	9.5786	12.4506	16.7111	21.2186	24.7653	26.4007	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	320.6010	323.9278	315.5443	297.6968	275.1675	253.9931	239.8474	236.5205	244.9041	262.7516	285.2808	306.4552	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.9400	51.9400	51.9400	51.9400	51.9400	51.9400	51.9400	51.9400	51.9400	51.9400	51.9400	51.9400	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-96.7998	-96.7998	-96.7998	-96.7998	-96.7998	-96.7998	-96.7998	-96.7998	-96.7998	-96.7998	-96.7998	-96.7998	(71)
Water heating gains (Table 5)													
	133.3252	130.5757	125.1363	113.0204	105.6412	97.9090	93.0749	96.9400	101.4874	110.0665	121.6705	131.7614	(72)
Total internal gains													
	579.9528	577.6581	559.5747	525.1038	491.6486	461.1067	442.8407	446.2510	463.4424	494.3766	532.0565	564.9572	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	10.7700	33.4622	0.6300	0.8270	0.7700	130.1217	(79)

Solar gains	130.1217	236.5633	338.2708	440.8830	488.8258	471.6574	460.3741	410.2716	362.9956	259.8861	160.1724	113.8804	(83)
Total gains	710.0745	814.2214	897.8455	965.9868	980.4745	932.7640	903.2148	856.5226	826.4381	754.2627	692.2289	678.8376	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	115.8048	115.8048	116.9449	120.5039	121.1182	123.6395	124.9399	124.9399	122.3658	119.2937	118.1076	118.6977	
alpha	8.7203	8.7203	8.7963	9.0336	9.0745	9.2426	9.3293	9.3293	9.1577	8.9529	8.8738	8.9132	
util living area													
	0.8344	0.7368	0.6203	0.4785	0.3690	0.2878	0.2300	0.2465	0.3450	0.5335	0.7340	0.8540	(86)
MIT	20.9304	20.9734	20.9935	20.9994	20.9999	21.0000	21.0000	21.0000	21.0000	20.9987	20.9792	20.9211	(87)
Th 2	20.5464	20.5464	20.5506	20.5634	20.5655	20.5740	20.5783	20.5783	20.5697	20.5591	20.5549	20.5570	(88)
util rest of house													
	0.8189	0.7194	0.6029	0.4627	0.3535	0.2721	0.2141	0.2298	0.3269	0.5129	0.7141	0.8395	(89)
MIT 2	20.4712	20.5185	20.5440	20.5628	20.5654	20.5740	20.5783	20.5783	20.5697	20.5579	20.5338	20.4710	(90)
Living area fraction										fLA = Living area / (4) =		0.4366	(91)
MIT	20.6717	20.7171	20.7402	20.7534	20.7551	20.7600	20.7624	20.7624	20.7576	20.7503	20.7283	20.6675	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6717	20.7171	20.7402	20.7534	20.7551	20.7600	20.7624	20.7624	20.7576	20.7503	20.7283	20.6675	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8233	0.7260	0.6103	0.4696	0.3603	0.2789	0.2210	0.2371	0.3348	0.5218	0.7219	0.8432	(94)
Useful gains	584.5997	591.1267	547.9509	453.5926	353.2254	260.1723	199.6517	203.0572	276.6985	393.5813	499.7477	572.4048	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	616.2386	603.2100	550.8727	453.8545	353.2468	260.1737	199.6518	203.0574	276.7067	394.1459	508.9914	608.2394	(97)
Space heating kWh													
	23.5394	8.1200	2.1738	0.1885	0.0159	0.0000	0.0000	0.0000	0.0000	0.4201	6.6554	26.6609	(98a)
Space heating requirement - total per year (kWh/year)												67.7740	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	23.5394	8.1200	2.1738	0.1885	0.0159	0.0000	0.0000	0.0000	0.0000	0.4201	6.6554	26.6609	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												67.7740	
Space heating per m2										(98c) / (4) =		0.8710	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	23.5394	8.1200	2.1738	0.1885	0.0159	0.0000	0.0000	0.0000	0.0000	0.4201	6.6554	26.6609	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	23.5394	8.1200	2.1738	0.1885	0.0159	0.0000	0.0000	0.0000	0.0000	0.4201	6.6554	26.6609	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	268.8283	237.2558	250.5050	216.1882	206.8828	183.4659	178.7645	187.4131	191.2145	216.7849	234.9193	265.3293	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	268.8283	237.2558	250.5050	216.1882	206.8828	183.4659	178.7645	187.4131	191.2145	216.7849	234.9193	265.3293	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	14.3575	12.9681	14.3575	13.8944	14.3575	13.8944	14.3575	14.3575	13.8944	14.3575	13.8944	14.3575	(231)

Lighting	22.4835	18.0371	16.2404	11.8984	9.1907	7.5089	8.3841	10.8979	14.1553	18.5725	20.9776	23.1084	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.6195	-27.9347	-47.1042	-61.7916	-72.0097	-67.8910	-67.3695	-59.5403	-48.4018	-34.1468	-19.6630	-14.3007	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.3323	-8.5458	-20.1242	-35.9677	-49.7264	-49.2018	-49.2896	-38.2557	-25.8244	-12.8321	-4.8454	-2.6438	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	67.7740	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2637.5516	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	169.0481	(230a)
Total electricity for the above, kWh/year	169.0481	(231)
Electricity for lighting (calculated in Appendix L)	181.4549	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-837.3617	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2218.4669	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	67.7740	25.1600	17.0519	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2637.5516	25.1600	663.6080	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	169.0481	25.1600	42.5325	(249)
Energy for lighting	181.4549	25.1600	45.6541	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-536.7728	25.1600	-135.0520	
PV Unit electricity exported	-300.5889	5.8100	-17.4642	
Total			-152.5162	(252)
Total energy cost			616.3302	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	67.7740	0.1609	10.9056	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2637.5516	0.1413	372.7121	(264)
Space and water heating			383.6177	(265)
Pumps, fans and electric keep-hot	169.0481	0.1387	23.4491	(267)
Energy for lighting	181.4549	0.1443	26.1896	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-536.7728	0.1320	-70.8695	
PV Unit electricity exported	-300.5889	0.1230	-36.9753	
Total			-107.8448	(269)
Total CO2, kg/year			325.4115	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	67.7740	1.5955	108.1309	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2637.5516	1.5225	4015.7597	(278)
Space and water heating			4123.8906	(279)
Pumps, fans and electric keep-hot	169.0481	1.5128	255.7360	(281)
Energy for lighting	181.4549	1.5338	278.3216	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-536.7728	1.4878	-798.6200	
PV Unit electricity exported	-300.5889	0.4514	-135.6996	
Total			-934.3196	(283)
Total Primary energy kWh/year			3723.6287	(286)

SAP 10 EPC IMPROVEMENTS

Unit 120 L06_Copy

Current energy efficiency rating: B 81
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: B 81
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£769	£769	£0
Space heating	£60	£60	£0
Water heating	£664	£664	£0
Lighting	£46	£46	£0
Generated (PV)	-£153	-£153	£0
Total cost of fuels	£616	£616	£0
Total cost of uses	£617	£617	£0
Delivered energy	29 kWh/m²	29 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	4 kg/m²	4 kg/m²	0 kg/m²
Primary energy	48 kWh/m²	48 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	77.8100 (1b)	x	2.4000 (2b)	=	186.7440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.8100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	186.7440	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.7700	1.2357	13.3089			(27)
External Wall 1	27.6400	10.7700	16.8700	0.1400	2.3618	14.0000	236.1800	(29a)
Total net area of external elements Aum(A, m2)			27.6400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		15.6707			(33)
Party Wall 1			23.2200	0.0000	0.0000	20.0000	464.4000	(32)
Wall to corridor			49.2700	0.0000	0.0000	20.0000	985.4000	(32)
Party Floor 1			77.8100			80.0000	6224.8000	(32d)
Party Ceiling 1			77.8100			80.0000	6224.8000	(32b)
Internal Wall 1			131.3800			9.0000	1182.4200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	15318.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		196.6642 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	4.6400	0.0500	0.2320
E4 Jamb	27.8400	0.0500	1.3920
E7 Party floor between dwellings (in blocks of flats)	19.2200	0.0700	1.3454
E18 Party wall between dwellings	2.7000	0.0600	0.1620
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	53.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.1314 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	18.8021 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	17.7616	17.5825	17.4034	16.5079	16.3288	15.4333	15.4333	15.2542	15.7915	16.3288	16.6870	17.0452	(38)
Heat transfer coeff	36.5638	36.3847	36.2056	35.3101	35.1310	34.2355	34.2355	34.0564	34.5937	35.1310	35.4892	35.8474	(39)
Average = Sum(39)m / 12 =												35.2653	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4699	0.4676	0.4653	0.4538	0.4515	0.4400	0.4400	0.4377	0.4446	0.4515	0.4561	0.4607	(40)
HLP (average)												0.4532	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4200 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	89.0932	87.7543	85.8032	82.0703	79.3155	76.2433	74.4971	76.4334	78.5559	81.8544	85.6676	88.7518	(42a)
Hot water usage for baths	27.9872	27.5716	26.9862	25.9070	25.0989	24.2028	23.7188	24.3000	24.9329	25.8917	26.9932	27.8926	(42b)
Hot water usage for other uses	39.4132	37.9800	36.5467	35.1135	33.6803	32.2471	32.2471	33.6803	35.1135	36.5467	37.9800	39.4132	(42c)
Average daily hot water use (litres/day)												143.9196	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	156.4935	153.3058	149.3362	143.0908	138.0947	132.6933	130.4630	134.4137	138.6023	144.2929	150.6407	156.0576	(44)
Energy conte	247.8475	218.3054	229.5242	195.8842	185.9020	163.1619	157.7837	166.4323	170.9105	195.8041	214.6153	244.3485	(45)
Energy content (annual)										Total = Sum(45)m =		2390.5196	
Distribution loss (46)m = 0.15 x (45)m	37.1771	32.7458	34.4286	29.3826	27.8853	24.4743	23.6676	24.9648	25.6366	29.3706	32.1923	36.6523	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	268.8283	237.2558	250.5050	216.1882	206.8828	183.4659	178.7645	187.4131	191.2145	216.7849	234.9193	265.3293	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	268.8283	237.2558	250.5050	216.1882	206.8828	183.4659	178.7645	187.4131	191.2145	216.7849	234.9193	265.3293	(64)
									Total per year (kWh/year) = Sum(64)m =			2637.5516	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	99.1939	87.7469	93.1014	81.3747	78.5971	70.4945	69.2477	72.1234	73.0709	81.8895	87.6028	98.0305	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	145.1996	145.1996	145.1996	145.1996	145.1996	145.1996	145.1996	145.1996	145.1996	145.1996	145.1996	145.1996	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.6868	22.8148	18.5542	14.0468	10.5001	8.8646	9.5786	12.4506	16.7111	21.2186	24.7653	26.4007	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	320.6010	323.9278	315.5443	297.6968	275.1675	253.9931	239.8474	236.5205	244.9041	262.7516	285.2808	306.4552	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9400	51.9400	51.9400	51.9400	51.9400	51.9400	51.9400	51.9400	51.9400	51.9400	51.9400	51.9400	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-96.7998	-96.7998	-96.7998	-96.7998	-96.7998	-96.7998	-96.7998	-96.7998	-96.7998	-96.7998	-96.7998	-96.7998	(71)
Water heating gains (Table 5)	133.3252	130.5757	125.1363	113.0204	105.6412	97.9090	93.0749	96.9400	101.4874	110.0665	121.6705	131.7614	(72)
Total internal gains	579.9528	577.6581	559.5747	525.1038	491.6486	461.1067	442.8407	446.2510	463.4424	494.3766	532.0565	564.9572	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	10.7700	36.7938	0.6300	0.8270	0.7700	143.0771	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	143.0771	243.7132	333.4590	413.1719	462.7869	459.4403	442.9495	405.9344	361.0656	269.3550	171.3733	122.4442	(83)
Total gains	723.0299	821.3713	893.0337	938.2756	954.4356	920.5469	885.7901	852.1854	824.5080	763.7315	703.4298	687.4013	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	116.3720	116.9449	117.5234	120.5039	121.1182	124.2863	124.2863	124.9399	122.9994	121.1182	119.8957	118.6977	
alpha	8.7581	8.7963	8.8349	9.0336	9.0745	9.2858	9.2858	9.3293	9.2000	9.0745	8.9930	8.9132	
util living area	0.8075	0.7023	0.5856	0.4552	0.3423	0.2380	0.1701	0.1838	0.2895	0.4781	0.6924	0.8304	(86)
MIT	20.9479	20.9826	20.9961	20.9996	21.0000	21.0000	21.0000	21.0000	21.0000	20.9995	20.9878	20.9387	(87)
Th 2	20.5485	20.5506	20.5527	20.5634	20.5655	20.5761	20.5761	20.5783	20.5719	20.5655	20.5612	20.5570	(88)
util rest of house	0.7909	0.6846	0.5680	0.4388	0.3263	0.2223	0.1537	0.1670	0.2715	0.4582	0.6723	0.8147	(89)
MIT 2	20.4930	20.5327	20.5489	20.5630	20.5655	20.5761	20.5761	20.5783	20.5719	20.5651	20.5491	20.4911	(90)
Living area fraction									fLA = Living area / (4) =			0.4366	(91)
MIT	20.6916	20.7291	20.7442	20.7536	20.7552	20.7612	20.7612	20.7624	20.7588	20.7548	20.7407	20.6865	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6916	20.7291	20.7442	20.7536	20.7552	20.7612	20.7612	20.7624	20.7588	20.7548	20.7407	20.6865	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7963	0.6917	0.5756	0.4459	0.3333	0.2291	0.1608	0.1743	0.2794	0.4669	0.6806	0.8194	(94)
Useful gains	575.7300	568.1162	514.0059	418.3948	318.1068	210.9311	142.4603	148.5672	230.3505	356.5563	478.7274	563.2356	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	599.3386	575.9383	515.7179	418.5526	318.1167	210.9312	142.4603	148.5673	230.3518	356.7466	484.0957	590.9978	(97)
Space heating kWh	17.5648	5.2564	1.2737	0.1137	0.0074	0.0000	0.0000	0.0000	0.0000	0.1415	3.8652	20.6551	(98a)
Space heating requirement - total per year (kWh/year)												48.8778	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	17.5648	5.2564	1.2737	0.1137	0.0074	0.0000	0.0000	0.0000	0.0000	0.1415	3.8652	20.6551	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												48.8778	
Space heating per m2										(98c) / (4) =		0.6282	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	17.5648	5.2564	1.2737	0.1137	0.0074	0.0000	0.0000	0.0000	0.0000	0.1415	3.8652	20.6551	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	17.5648	5.2564	1.2737	0.1137	0.0074	0.0000	0.0000	0.0000	0.0000	0.1415	3.8652	20.6551	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	268.8283	237.2558	250.5050	216.1882	206.8828	183.4659	178.7645	187.4131	191.2145	216.7849	234.9193	265.3293	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	268.8283	237.2558	250.5050	216.1882	206.8828	183.4659	178.7645	187.4131	191.2145	216.7849	234.9193	265.3293	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	14.3575	12.9681	14.3575	13.8944	14.3575	13.8944	14.3575	14.3575	13.8944	14.3575	13.8944	14.3575	(231)
Lighting	22.4835	18.0371	16.2404	11.8984	9.1907	7.5089	8.3841	10.8979	14.1553	18.5725	20.9776	23.1084	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-18.3305	-29.0186	-47.1029	-59.3107	-69.5891	-66.9307	-65.8641	-59.5224	-48.7201	-35.6313	-21.1381	-15.4631	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.9307	-9.1438	-20.1484	-33.3783	-46.6132	-47.8770	-47.1985	-38.2342	-26.1316	-13.8104	-5.4774	-3.0178	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												48.8778	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2637.5516	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	169.0481	(230a)
Total electricity for the above, kWh/year	169.0481	(231)
Electricity for lighting (calculated in Appendix L)	181.4549	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-831.5829	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2205.3496	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	48.8778	16.4900	8.0600	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2637.5516	16.4900	434.9323	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	169.0481	16.4900	27.8760	(249)
Energy for lighting	181.4549	16.4900	29.9219	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-536.6215	16.4900	-88.4889	
PV Unit electricity exported	-294.9613	5.5900	-16.4883	
Total			-104.9772	(252)
Total energy cost			395.8129	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1603	(257)
SAP value		81.1920	
SAP rating (Section 12)		81	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	48.8778	0.1613	7.8859	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2637.5516	0.1413	372.7121	(264)
Space and water heating			380.5980	(265)
Pumps, fans and electric keep-hot	169.0481	0.1387	23.4491	(267)
Energy for lighting	181.4549	0.1443	26.1896	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-536.6215	0.1323	-71.0159	
PV Unit electricity exported	-294.9613	0.1235	-36.4272	
Total			-107.4431	(269)
Total CO2, kg/year			322.7934	(272)
CO2 emissions per m2			4.1500	(273)
EI value			96.4779	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		77.8100 (1b)	x	2.4000 (2b)	=	186.7440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.8100						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	186.7440	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.7700	1.2357	13.3089			(27)
External Wall 1	27.6400	10.7700	16.8700	0.1400	2.3618	14.0000	236.1800	(29a)
Total net area of external elements Aum(A, m2)			27.6400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	15.6707			(33)
Party Wall 1			23.2200	0.0000	0.0000	20.0000	464.4000	(32)
Wall to corridor			49.2700	0.0000	0.0000	20.0000	985.4000	(32)
Party Floor 1			77.8100			80.0000	6224.8000	(32d)
Party Ceiling 1			77.8100			80.0000	6224.8000	(32b)
Internal Wall 1			131.3800			9.0000	1182.4200	(32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		15318.0000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							196.8642	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	4.6400	0.0500	0.2320
E4 Jamb	27.8400	0.0500	1.3920
E7 Party floor between dwellings (in blocks of flats)	19.2200	0.0700	1.3454
E18 Party wall between dwellings	2.7000	0.0600	0.1620
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	53.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.1314 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	18.8021 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	17.9407	17.9407	17.5825	16.5079	16.3288	15.6124	15.2542	15.2542	15.9706	16.8661	17.2243	17.0452	(38)
Heat transfer coeff	36.7429	36.7429	36.3847	35.3101	35.1310	34.4146	34.0564	34.0564	34.7728	35.6683	36.0265	35.8474	(39)
Average = Sum(39)m / 12 =												35.4295	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4722	0.4722	0.4676	0.4538	0.4515	0.4423	0.4377	0.4377	0.4469	0.4584	0.4630	0.4607	(40)
HLP (average)												0.4553	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4200 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	89.0932	87.7543	85.8032	82.0703	79.3155	76.2433	74.4971	76.4334	78.5559	81.8544	85.6676	88.7518	(42a)
Hot water usage for baths	27.9872	27.5716	26.9862	25.9070	25.0989	24.2028	23.7188	24.3000	24.9329	25.8917	26.9932	27.8926	(42b)
Hot water usage for other uses	39.4132	37.9800	36.5467	35.1135	33.6803	32.2471	32.2471	33.6803	35.1135	36.5467	37.9800	39.4132	(42c)
Average daily hot water use (litres/day)												143.9196	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	156.4935	153.3058	149.3362	143.0908	138.0947	132.6933	130.4630	134.4137	138.6023	144.2929	150.6407	156.0576	(44)
Energy conte	247.8475	218.3054	229.5242	195.8842	185.9020	163.1619	157.7837	166.4323	170.9105	195.8041	214.6153	244.3485	(45)
Energy content (annual)										Total = Sum(45)m =		2390.5196	
Distribution loss (46)m = 0.15 x (45)m	37.1771	32.7458	34.4286	29.3826	27.8853	24.4743	23.6676	24.9648	25.6366	29.3706	32.1923	36.6523	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	268.8283	237.2558	250.5050	216.1882	206.8828	183.4659	178.7645	187.4131	191.2145	216.7849	234.9193	265.3293	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	268.8283	237.2558	250.5050	216.1882	206.8828	183.4659	178.7645	187.4131	191.2145	216.7849	234.9193	265.3293	(64)
									Total per year (kWh/year) = Sum(64)m =			2637.5516	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	99.1939	87.7469	93.1014	81.3747	78.5971	70.4945	69.2477	72.1234	73.0709	81.8895	87.6028	98.0305	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.1996	145.1996	145.1996	145.1996	145.1996	145.1996	145.1996	145.1996	145.1996	145.1996	145.1996	145.1996	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.6868	22.8148	18.5542	14.0468	10.5001	8.8646	9.5786	12.4506	16.7111	21.2186	24.7653	26.4007	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	320.6010	323.9278	315.5443	297.6968	275.1675	253.9931	239.8474	236.5205	244.9041	262.7516	285.2808	306.4552	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9400	51.9400	51.9400	51.9400	51.9400	51.9400	51.9400	51.9400	51.9400	51.9400	51.9400	51.9400	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-96.7998	-96.7998	-96.7998	-96.7998	-96.7998	-96.7998	-96.7998	-96.7998	-96.7998	-96.7998	-96.7998	-96.7998	(71)
Water heating gains (Table 5)	133.3252	130.5757	125.1363	113.0204	105.6412	97.9090	93.0749	96.9400	101.4874	110.0665	121.6705	131.7614	(72)
Total internal gains	579.9528	577.6581	559.5747	525.1038	491.6486	461.1067	442.8407	446.2510	463.4424	494.3766	532.0565	564.9572	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	10.7700	33.4622	0.6300	0.8270	0.7700	130.1217	(79)

Solar gains	130.1217	236.5633	338.2708	440.8830	488.8258	471.6574	460.3741	410.2716	362.9956	259.8861	160.1724	113.8804	(83)
Total gains	710.0745	814.2214	897.8455	965.9868	980.4745	932.7640	903.2148	856.5226	826.4381	754.2627	692.2289	678.8376	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	115.8048	115.8048	116.9449	120.5039	121.1182	123.6395	124.9399	124.9399	122.3658	119.2937	118.1076	118.6977	
alpha	8.7203	8.7203	8.7963	9.0336	9.0745	9.2426	9.3293	9.3293	9.1577	8.9529	8.8738	8.9132	
util living area	0.8344	0.7368	0.6203	0.4785	0.3690	0.2878	0.2300	0.2465	0.3450	0.5335	0.7340	0.8540	(86)
MIT	20.9304	20.9734	20.9935	20.9994	20.9999	21.0000	21.0000	21.0000	21.0000	20.9987	20.9792	20.9211	(87)
Th 2	20.5464	20.5464	20.5506	20.5634	20.5655	20.5740	20.5783	20.5783	20.5697	20.5591	20.5549	20.5570	(88)
util rest of house	0.8189	0.7194	0.6029	0.4627	0.3535	0.2721	0.2141	0.2298	0.3269	0.5129	0.7141	0.8395	(89)
MIT 2	20.4712	20.5185	20.5440	20.5628	20.5654	20.5740	20.5783	20.5783	20.5697	20.5579	20.5338	20.4710	(90)
Living area fraction										fLA = Living area / (4) =		0.4366	(91)
MIT	20.6717	20.7171	20.7402	20.7534	20.7551	20.7600	20.7624	20.7624	20.7576	20.7503	20.7283	20.6675	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6717	20.7171	20.7402	20.7534	20.7551	20.7600	20.7624	20.7624	20.7576	20.7503	20.7283	20.6675	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8233	0.7260	0.6103	0.4696	0.3603	0.2789	0.2210	0.2371	0.3348	0.5218	0.7219	0.8432	(94)
Useful gains	584.5997	591.1267	547.9509	453.5926	353.2254	260.1723	199.6517	203.0572	276.6985	393.5813	499.7477	572.4048	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	616.2386	603.2100	550.8727	453.8545	353.2468	260.1737	199.6518	203.0574	276.7067	394.1459	508.9914	608.2394	(97)
Space heating kWh	23.5394	8.1200	2.1738	0.1885	0.0159	0.0000	0.0000	0.0000	0.0000	0.4201	6.6554	26.6609	(98a)
Space heating requirement - total per year (kWh/year)												67.7740	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	23.5394	8.1200	2.1738	0.1885	0.0159	0.0000	0.0000	0.0000	0.0000	0.4201	6.6554	26.6609	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												67.7740	
Space heating per m2											(98c) / (4) =	0.8710	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	23.5394	8.1200	2.1738	0.1885	0.0159	0.0000	0.0000	0.0000	0.0000	0.4201	6.6554	26.6609	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													

	23.5394	8.1200	2.1738	0.1885	0.0159	0.0000	0.0000	0.0000	0.0000	0.4201	6.6554	26.6609 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	268.8283	237.2558	250.5050	216.1882	206.8828	183.4659	178.7645	187.4131	191.2145	216.7849	234.9193	265.3293 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	268.8283	237.2558	250.5050	216.1882	206.8828	183.4659	178.7645	187.4131	191.2145	216.7849	234.9193	265.3293 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	14.3575	12.9681	14.3575	13.8944	14.3575	13.8944	14.3575	14.3575	13.8944	14.3575	13.8944	14.3575 (231)
Lighting	22.4835	18.0371	16.2404	11.8984	9.1907	7.5089	8.3841	10.8979	14.1553	18.5725	20.9776	23.1084 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-16.6195	-27.9347	-47.1042	-61.7916	-72.0097	-67.8910	-67.3695	-59.5403	-48.4018	-34.1468	-19.6630	-14.3007 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-3.3323	-8.5458	-20.1242	-35.9677	-49.7264	-49.2018	-49.2896	-38.2557	-25.8244	-12.8321	-4.8454	-2.6438 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	67.7740 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2637.5516 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	169.0481 (230a)
Total electricity for the above, kWh/year	169.0481 (231)
Electricity for lighting (calculated in Appendix L)	181.4549 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-837.3617 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2218.4669 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	67.7740	25.1600	17.0519	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2637.5516	25.1600	663.6080	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	169.0481	25.1600	42.5325	(249)
Energy for lighting	181.4549	25.1600	45.6541	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-536.7728	25.1600	-135.0520	
PV Unit electricity exported	-300.5889	5.8100	-17.4642	
Total			-152.5162	(252)
Total energy cost			616.3302	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	67.7740	0.1609	10.9056	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2637.5516	0.1413	372.7121	(264)
Space and water heating			383.6177	(265)
Pumps, fans and electric keep-hot	169.0481	0.1387	23.4491	(267)
Energy for lighting	181.4549	0.1443	26.1896	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-536.7728	0.1320	-70.8695	
PV Unit electricity exported	-300.5889	0.1230	-36.9753	
Total			-107.8448	(269)
Total CO2, kg/year			325.4115	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	67.7740	1.5955	108.1309	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2637.5516	1.5225	4015.7597	(278)
Space and water heating			4123.8906	(279)

Pumps, fans and electric keep-hot	169.0481	1.5128	255.7360 (281)
Energy for lighting	181.4549	1.5338	278.3216 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-536.7728	1.4878	-798.6200
PV Unit electricity exported	-300.5889	0.4514	-135.6996
Total			-934.3196 (283)
Total Primary energy kWh/year			3723.6287 (286)

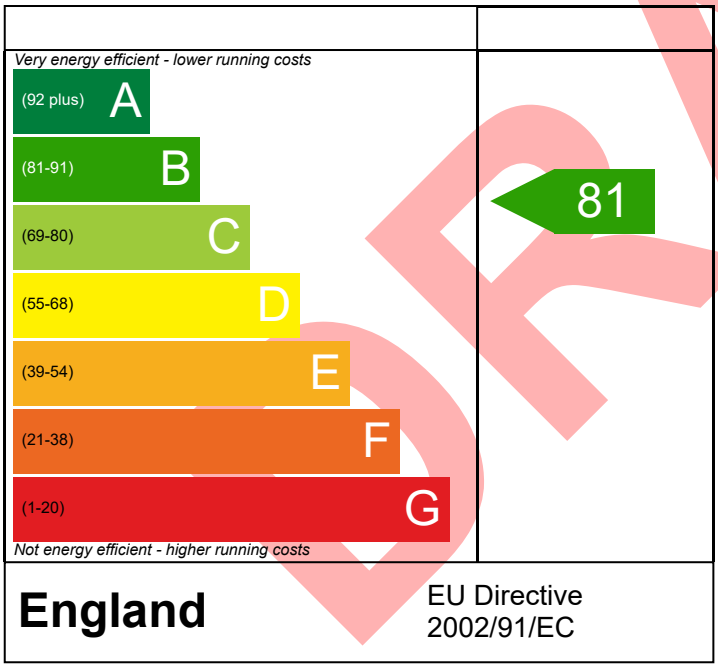
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	77.81 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

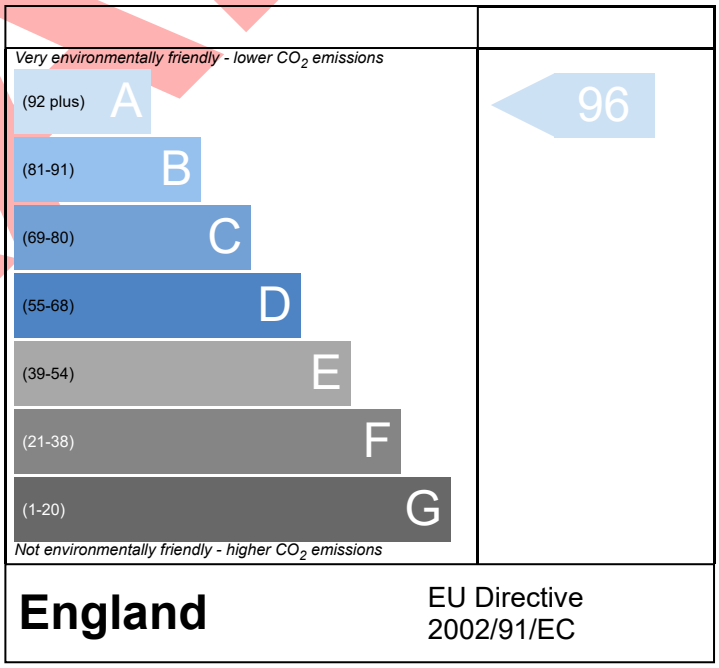
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:20

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	72 m^2
Site Reference	Unit 121 L06_Copy	Plot Reference	Unit 121 L06_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*9.47 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	4.4 kgCO_2/m^2	**OK**
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*51.17 kWh$_{PE}$/m^2*	
Dwelling primary energy	50.08 kWh$_{PE}$/m^2	**OK**
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*13.9 kWh/m^2*	
Dwelling fabric energy efficiency	12.8 kWh/m^2	**OK**

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	**OK**
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	**OK**
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	12.04	0.14 **(!)**
Party wall: Party Wall (1)	54.38	0 **(!)**
Party wall: Party Wall (2)	14.88	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	10.77	South West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.93 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 121 L06_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 121 L06_Copy	**Prop Type Ref**	Unit 121 L06
Property			

SAP Rating	81 B	**DER**	4.40	**TER**	9.47
Environmental	96 A	**% DER < TER**			53.54
CO_2 Emissions (t/year)	0.32	**DFEE**	12.75	**TFEE**	13.92
Compliance Check	See BREL	**% DFEE < TFEE**			8.37
% DPER < TPER	2.12	**DPER**	50.08	**TPER**	51.17

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	72.0800 (1b)	x	2.4000 (2b)	=	172.9920	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	172.9920	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.7700	1.2357	13.3089			(27)
External Wall 1	22.8100	10.7700	12.0400	0.1400	1.6856	14.0000	168.5600	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.9945			(33)
Party Wall 1			54.3800	0.0000	0.0000	20.0000	1087.6000	(32)
Wall to corridor			14.8800	0.0000	0.0000	20.0000	297.6000	(32)
Party Floor 1			72.0800			80.0000	5766.4000	(32d)
Party Ceiling 1			72.0800			80.0000	5766.4000	(32b)
Internal Wall 1			136.8900			9.0000	1232.0100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 14318.5700	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.6483	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	4.6400	0.0500	0.2320

E4 Jamb	27.8400	0.0500	1.3920	
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.5395 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 17.5340 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.4536	16.2877	16.1218	15.2923	15.1264	14.2968	14.2968	14.1309	14.6286	15.1264	15.4582	15.7900	(38)
Heat transfer coeff	33.9877	33.8218	33.6559	32.8263	32.6604	31.8309	31.8309	31.6649	32.1627	32.6604	32.9922	33.3240	(39)

Average = Sum(39)m / 12 = 32.7848

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4715	0.4692	0.4669	0.4554	0.4531	0.4416	0.4416	0.4393	0.4462	0.4531	0.4577	0.4623	(40)
HLP (average)												0.4548	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2955 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	86.2240	84.9283	83.0401	79.4273	76.7612	73.7880	72.0980	73.9719	76.0261	79.2184	82.9088	85.8937	(42a)
Hot water usage for baths	27.0899	26.6876	26.1210	25.0764	24.2942	23.4268	22.9583	23.5209	24.1335	25.0616	26.1277	26.9983	(42b)
Hot water usage for other uses	38.1387	36.7518	35.3650	33.9781	32.5912	31.2044	31.2044	32.5912	33.9781	35.3650	36.7518	38.1387	(42c)

Average daily hot water use (litres/day) 139.2838 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.4526	148.3676	144.5260	138.4818	133.6466	128.4192	126.2607	130.0841	134.1377	139.6450	145.7883	151.0307	(44)
Energy conte	239.8639	211.2735	222.1311	189.5747	179.9140	157.9064	152.7014	161.0713	165.4052	189.4969	207.7021	236.4775	(45)

Energy content (annual) Total = Sum(45)m = 2313.5180

Distribution loss (46)m = 0.15 x (45)m	35.9796	31.6910	33.3197	28.4362	26.9871	23.6860	22.9052	24.1607	24.8108	28.4245	31.1553	35.4716	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	260.8447	230.2239	243.1119	209.8787	200.8948	178.2104	173.6822	182.0521	185.7092	210.4777	228.0061	257.4583	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	260.8447	230.2239	243.1119	209.8787	200.8948	178.2104	173.6822	182.0521	185.7092	210.4777	228.0061	257.4583	(64)

Total per year (kWh/year) = Sum(64)m = 2560.5500 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	96.5394	85.4088	90.6432	79.2768	76.6061	68.7471	67.5579	70.3408	71.2404	79.7924	85.3042	95.4134	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.8367	21.1715	17.2179	13.0350	9.7438	8.2262	8.8886	11.5538	15.5075	19.6903	22.9815	24.4992	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.6450	304.7751	296.8873	280.0950	258.8978	238.9754	225.6661	222.5359	230.4238	247.2160	268.4132	288.3356	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	(71)
Water heating gains (Table 5)	129.7572	127.0964	121.8323	110.1066	102.9651	95.4820	90.8036	94.5441	98.9450	107.2478	118.4780	128.2438	(72)
Total internal gains	552.2186	550.0227	532.9171	500.2164	468.5865	439.6633	422.3380	425.6136	441.8560	471.1338	506.8524	538.0583	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	10.7700	36.7938	0.6300	0.8270	0.7700	143.0771	(79)

Solar gains	143.0771	243.7132	333.4590	413.1719	462.7869	459.4403	442.9495	405.9344	361.0656	269.3550	171.3733	122.4442	(83)
Total gains	695.2957	793.7359	866.3761	913.3882	931.3734	899.1036	865.2874	831.5480	802.9215	740.4888	678.2258	660.5025	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	117.0242	117.5982	118.1779	121.1644	121.7799	124.9536	124.9536	125.6083	123.6645	121.7799	120.5551	119.3547	
alpha	8.8016	8.8399	8.8785	9.0776	9.1187	9.3302	9.3302	9.3739	9.2443	9.1187	9.0370	8.9570	
util living area													
	0.7872	0.6781	0.5618	0.4347	0.3261	0.2266	0.1619	0.1752	0.2764	0.4585	0.6697	0.8112	(86)
MIT	20.9578	20.9869	20.9973	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9997	20.9908	20.9498	(87)
Th 2	20.5470	20.5491	20.5512	20.5619	20.5640	20.5746	20.5746	20.5768	20.5704	20.5640	20.5597	20.5555	(88)
util rest of house													
	0.7702	0.6605	0.5447	0.4190	0.3108	0.2115	0.1462	0.1590	0.2592	0.4393	0.6498	0.7949	(89)
MIT 2	20.5024	20.5358	20.5486	20.5616	20.5640	20.5746	20.5746	20.5768	20.5704	20.5637	20.5507	20.5019	(90)
Living area fraction										fLA = Living area / (4) =		0.4075	(91)
MIT	20.6880	20.7196	20.7314	20.7402	20.7416	20.7480	20.7480	20.7492	20.7454	20.7414	20.7300	20.6844	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6880	20.7196	20.7314	20.7402	20.7416	20.7480	20.7480	20.7492	20.7454	20.7414	20.7300	20.6844	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7756	0.6672	0.5516	0.4254	0.3171	0.2177	0.1526	0.1656	0.2662	0.4471	0.6575	0.7997	(94)
Useful gains	539.2405	529.5966	477.8566	388.5732	295.2978	195.6948	132.0332	137.7180	213.7342	331.1017	445.9274	528.2157	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	556.9888	535.0469	478.9702	388.6688	295.3035	195.6949	132.0332	137.7180	213.7349	331.2210	449.6838	549.3278	(97)
Space heating kWh													
	13.2047	3.6626	0.8285	0.0688	0.0042	0.0000	0.0000	0.0000	0.0000	0.0888	2.7046	15.7074	(98a)
Space heating requirement - total per year (kWh/year)												36.2696	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	13.2047	3.6626	0.8285	0.0688	0.0042	0.0000	0.0000	0.0000	0.0000	0.0888	2.7046	15.7074	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												36.2696	
Space heating per m2											(98c) / (4) =	0.5032	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	13.2047	3.6626	0.8285	0.0688	0.0042	0.0000	0.0000	0.0000	0.0000	0.0888	2.7046	15.7074	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	13.2047	3.6626	0.8285	0.0688	0.0042	0.0000	0.0000	0.0000	0.0000	0.0888	2.7046	15.7074	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	260.8447	230.2239	243.1119	209.8787	200.8948	178.2104	173.6822	182.0521	185.7092	210.4777	228.0061	257.4583	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	260.8447	230.2239	243.1119	209.8787	200.8948	178.2104	173.6822	182.0521	185.7092	210.4777	228.0061	257.4583	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.3002	12.0131	13.3002	12.8712	13.3002	12.8712	13.3002	13.3002	12.8712	13.3002	12.8712	13.3002	(231)
Lighting	20.8641	16.7380	15.0707	11.0414	8.5287	6.9680	7.7802	10.1130	13.1358	17.2348	19.4667	21.4440	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.9291	-26.8464	-43.6554	-55.0679	-64.6967	-62.2591	-61.2682	-55.3254	-45.2257	-33.0107	-19.5434	-14.2765	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.5687	-8.2932	-18.2691	-30.2794	-42.3016	-43.4549	-42.8389	-34.6881	-23.6972	-12.5148	-4.9640	-2.7406	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	36.2696	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2560.5500	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	156.5993	(230a)
Total electricity for the above, kWh/year	156.5993	(231)
Electricity for lighting (calculated in Appendix L)	168.3854	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-765.7149	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2156.0893	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	36.2696	16.4900	5.9809	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2560.5500	16.4900	422.2347	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	156.5993	16.4900	25.8232	(249)
Energy for lighting	168.3854	16.4900	27.7667	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.1044	16.4900	-82.1374	
PV Unit electricity exported	-267.6105	5.5900	-14.9594	
Total			-97.0968	(252)
Total energy cost			384.7087	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1829	(257)
SAP value		80.8250	
SAP rating (Section 12)		81	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	36.2696	0.1615	5.8563	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2560.5500	0.1413	361.8103	(264)
Space and water heating			367.6666	(265)
Pumps, fans and electric keep-hot	156.5993	0.1387	21.7223	(267)
Energy for lighting	168.3854	0.1443	24.3032	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.1044	0.1323	-65.9022	
PV Unit electricity exported	-267.6105	0.1235	-33.0479	
Total			-98.9501	(269)
Total CO2, kg/year			314.7420	(272)
CO2 emissions per m2			4.3700	(273)
EI value			96.3977	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		72.0800 (1b)	x	2.4000 (2b)	=	172.9920	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	172.9920	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.7700	1.2357	13.3089			(27)
External Wall 1	22.8100	10.7700	12.0400	0.1400	1.6856	14.0000	168.5600	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.9945			(33)
Party Wall 1			54.3800	0.0000	0.0000	20.0000	1087.6000	(32)
Wall to corridor			14.8800	0.0000	0.0000	20.0000	297.6000	(32)
Party Floor 1			72.0800			80.0000	5766.4000	(32d)
Party Ceiling 1			72.0800			80.0000	5766.4000	(32b)
Internal Wall 1			136.8900			9.0000	1232.0100	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14318.5700 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 198.6483 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	4.6400	0.0500	0.2320
E4	Jamb	27.8400	0.0500	1.3920
E7	Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18	Party wall between dwellings	5.4000	0.0600	0.3240
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.5395 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 17.5340 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.6196	16.6196	16.2877	15.2923	15.1264	14.4627	14.1309	14.1309	14.7945	15.6241	15.9559	15.7900	(38)
Heat transfer coeff	34.1536	34.1536	33.8218	32.8263	32.6604	31.9968	31.6649	31.6649	32.3286	33.1581	33.4900	33.3240	(39)
Average = Sum(39)m / 12 =												32.9369	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4738	0.4738	0.4692	0.4554	0.4531	0.4439	0.4393	0.4393	0.4485	0.4600	0.4646	0.4623	(40)
HLP (average)												0.4569	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2955 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	86.2240	84.9283	83.0401	79.4273	76.7612	73.7880	72.0980	73.9719	76.0261	79.2184	82.9088	85.8937	(42a)
Hot water usage for baths	27.0899	26.6876	26.1210	25.0764	24.2942	23.4268	22.9583	23.5209	24.1335	25.0616	26.1277	26.9983	(42b)
Hot water usage for other uses	38.1387	36.7518	35.3650	33.9781	32.5912	31.2044	31.2044	32.5912	33.9781	35.3650	36.7518	38.1387	(42c)
Average daily hot water use (litres/day)												139.2838	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.4526	148.3676	144.5260	138.4818	133.6466	128.4192	126.2607	130.0841	134.1377	139.6450	145.7883	151.0307	(44)
Energy conte	239.8639	211.2735	222.1311	189.5747	179.9140	157.9064	152.7014	161.0713	165.4052	189.4969	207.7021	236.4775	(45)
Energy content (annual)										Total = Sum(45)m =		2313.5180	
Distribution loss (46)m = 0.15 x (45)m	35.9796	31.6910	33.3197	28.4362	26.9871	23.6860	22.9052	24.1607	24.8108	28.4245	31.1553	35.4716	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	260.8447	230.2239	243.1119	209.8787	200.8948	178.2104	173.6822	182.0521	185.7092	210.4777	228.0061	257.4583	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	260.8447	230.2239	243.1119	209.8787	200.8948	178.2104	173.6822	182.0521	185.7092	210.4777	228.0061	257.4583	(64)
										Total per year (kWh/year) = Sum(64)m =		2560.5500	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	96.5394	85.4088	90.6432	79.2768	76.6061	68.7471	67.5579	70.3408	71.2404	79.7924	85.3042	95.4134	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.8367	21.1715	17.2179	13.0350	9.7438	8.2262	8.8886	11.5538	15.5075	19.6903	22.9815	24.4992	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	301.6450	304.7751	296.8873	280.0950	258.8978	238.9754	225.6661	222.5359	230.4238	247.2160	268.4132	288.3356	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	(71)
Water heating gains (Table 5)													
	129.7572	127.0964	121.8323	110.1066	102.9651	95.4820	90.8036	94.5441	98.9450	107.2478	118.4780	128.2438	(72)
Total internal gains													
	552.2186	550.0227	532.9171	500.2164	468.5865	439.6633	422.3380	425.6136	441.8560	471.1338	506.8524	538.0583	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	10.7700	33.4622	0.6300	0.8270	0.7700	130.1217	(79)

Solar gains	130.1217	236.5633	338.2708	440.8830	488.8258	471.6574	460.3741	410.2716	362.9956	259.8861	160.1724	113.8804	(83)
Total gains	682.3403	786.5860	871.1879	941.0994	957.4123	911.3207	882.7121	835.8852	804.8516	731.0199	667.0249	651.9387	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	116.4557	116.4557	117.5982	121.1644	121.7799	124.3057	125.6083	125.6083	123.0299	119.9519	118.7634	119.3547	
alpha	8.7637	8.7637	8.8399	9.0776	9.1187	9.2870	9.3739	9.3739	9.2020	8.9968	8.9176	8.9570	
util living area													
	0.8155	0.7127	0.5953	0.4567	0.3513	0.2739	0.2188	0.2349	0.3294	0.5119	0.7114	0.8361	(86)
MIT	20.9426	20.9796	20.9953	20.9996	21.0000	21.0000	21.0000	21.0000	21.0000	20.9991	20.9839	20.9344	(87)
Th 2	20.5449	20.5449	20.5491	20.5619	20.5640	20.5725	20.5768	20.5768	20.5683	20.5576	20.5534	20.5555	(88)
util rest of house													
	0.7994	0.6953	0.5784	0.4415	0.3365	0.2589	0.2036	0.2188	0.3120	0.4921	0.6915	0.8210	(89)
MIT 2	20.4834	20.5237	20.5445	20.5615	20.5640	20.5725	20.5768	20.5768	20.5682	20.5568	20.5372	20.4846	(90)
Living area fraction										fLA = Living area / (4) =		0.4075	(91)
MIT	20.6705	20.7095	20.7282	20.7400	20.7416	20.7467	20.7492	20.7492	20.7442	20.7370	20.7192	20.6679	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6705	20.7095	20.7282	20.7400	20.7416	20.7467	20.7492	20.7492	20.7442	20.7370	20.7192	20.6679	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8039	0.7016	0.5851	0.4477	0.3425	0.2650	0.2098	0.2254	0.3191	0.5001	0.6990	0.8249	(94)
Useful gains	548.5519	551.8680	509.7401	421.3315	327.9511	241.4691	185.2153	188.3818	256.8188	365.6040	466.2314	537.7691	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	572.7731	560.4418	511.6622	421.4901	327.9634	241.4699	185.2154	188.3819	256.8235	365.9661	472.8521	565.4381	(97)
Space heating kWh													
	18.0206	5.7616	1.4300	0.1142	0.0092	0.0000	0.0000	0.0000	0.0000	0.2694	4.7669	20.5857	(98a)
Space heating requirement - total per year (kWh/year)												50.9576	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	18.0206	5.7616	1.4300	0.1142	0.0092	0.0000	0.0000	0.0000	0.0000	0.2694	4.7669	20.5857	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												50.9576	
Space heating per m2										(98c) / (4) =		0.7070	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	18.0206	5.7616	1.4300	0.1142	0.0092	0.0000	0.0000	0.0000	0.0000	0.2694	4.7669	20.5857	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	18.0206	5.7616	1.4300	0.1142	0.0092	0.0000	0.0000	0.0000	0.0000	0.2694	4.7669	20.5857	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	260.8447	230.2239	243.1119	209.8787	200.8948	178.2104	173.6822	182.0521	185.7092	210.4777	228.0061	257.4583	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	260.8447	230.2239	243.1119	209.8787	200.8948	178.2104	173.6822	182.0521	185.7092	210.4777	228.0061	257.4583	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.3002	12.0131	13.3002	12.8712	13.3002	12.8712	13.3002	13.3002	12.8712	13.3002	12.8712	13.3002	(231)

Lighting	20.8641	16.7380	15.0707	11.0414	8.5287	6.9680	7.7802	10.1130	13.1358	17.2348	19.4667	21.4440 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-15.3441	-25.8360	-43.6523	-57.3837	-66.9624	-63.1589	-62.6788	-55.3422	-44.9287	-31.6294	-18.1738	-13.1999 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-3.0274	-7.7549	-18.2510	-32.6323	-45.1312	-44.6592	-44.7399	-34.7076	-23.4182	-11.6284	-4.3934	-2.4025 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	50.9576 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2560.5500 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	156.5993 (230a)
Total electricity for the above, kWh/year	156.5993 (231)
Electricity for lighting (calculated in Appendix L)	168.3854 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-771.0360 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2165.4562 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	50.9576	25.1600	12.8209	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2560.5500	25.1600	644.2344	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	156.5993	25.1600	39.4004	(249)
Energy for lighting	168.3854	25.1600	42.3658	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.2900	25.1600	-125.3698	
PV Unit electricity exported	-272.7460	5.8100	-15.8465	
Total			-141.2163	(252)
Total energy cost			597.6051	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	50.9576	0.1611	8.2075	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2560.5500	0.1413	361.8103	(264)
Space and water heating			370.0178	(265)
Pumps, fans and electric keep-hot	156.5993	0.1387	21.7223	(267)
Energy for lighting	168.3854	0.1443	24.3032	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.2900	0.1320	-65.7720	
PV Unit electricity exported	-272.7460	0.1230	-33.5496	
Total			-99.3216	(269)
Total CO2, kg/year			316.7216	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	50.9576	1.5960	81.3293	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2560.5500	1.5225	3898.4448	(278)
Space and water heating			3979.7741	(279)
Pumps, fans and electric keep-hot	156.5993	1.5128	236.9034	(281)
Energy for lighting	168.3854	1.5338	258.2751	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.2900	1.4877	-741.3020	
PV Unit electricity exported	-272.7460	0.4514	-123.1271	
Total			-864.4291	(283)
Total Primary energy kWh/year			3610.5235	(286)

SAP 10 EPC IMPROVEMENTS

Unit 121 L06_Copy

Current energy efficiency rating: B 81
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: B 81
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£739	£739	£0
Space heating	£52	£52	£0
Water heating	£644	£644	£0
Lighting	£42	£42	£0
Generated (PV)	-£141	-£141	£0
Total cost of fuels	£598	£598	£0
Total cost of uses	£597	£597	£0
Delivered energy	30 kWh/m²	30 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	4 kg/m²	4 kg/m²	0 kg/m²
Primary energy	50 kWh/m²	50 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	72.0800 (1b)	x	2.4000 (2b)	=	172.9920	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	172.9920	(5)

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2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.7700	1.2357	13.3089			(27)
External Wall 1	22.8100	10.7700	12.0400	0.1400	1.6856	14.0000	168.5600	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.9945			(33)
Party Wall 1			54.3800	0.0000	0.0000	20.0000	1087.6000	(32)
Wall to corridor			14.8800	0.0000	0.0000	20.0000	297.6000	(32)
Party Floor 1			72.0800			80.0000	5766.4000	(32d)
Party Ceiling 1			72.0800			80.0000	5766.4000	(32b)
Internal Wall 1			136.8900			9.0000	1232.0100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14318.5700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		198.6483 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	4.6400	0.0500	0.2320
E4 Jamb	27.8400	0.0500	1.3920
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		2.5395 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	17.5340 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.4536	16.2877	16.1218	15.2923	15.1264	14.2968	14.2968	14.1309	14.6286	15.1264	15.4582	15.7900	(38)
Heat transfer coeff	33.9877	33.8218	33.6559	32.8263	32.6604	31.8309	31.8309	31.6649	32.1627	32.6604	32.9922	33.3240	(39)
Average = Sum(39)m / 12 =												32.7848	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4715	0.4692	0.4669	0.4554	0.4531	0.4416	0.4416	0.4393	0.4462	0.4531	0.4577	0.4623	(40)
HLP (average)												0.4548	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.2955 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
86.2240	84.9283	83.0401	79.4273	76.7612	73.7880	72.0980	73.9719	76.0261	79.2184	82.9088	85.8937	(42a)

Hot water usage for baths

27.0899	26.6876	26.1210	25.0764	24.2942	23.4268	22.9583	23.5209	24.1335	25.0616	26.1277	26.9983	(42b)

Hot water usage for other uses

38.1387	36.7518	35.3650	33.9781	32.5912	31.2044	31.2044	32.5912	33.9781	35.3650	36.7518	38.1387	(42c)

Average daily hot water use (litres/day)		139.2838 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.4526	148.3676	144.5260	138.4818	133.6466	128.4192	126.2607	130.0841	134.1377	139.6450	145.7883	151.0307	(44)
Energy conte	239.8639	211.2735	222.1311	189.5747	179.9140	157.9064	152.7014	161.0713	165.4052	189.4969	207.7021	236.4775	(45)
Energy content (annual)										Total = Sum(45)m =		2313.5180	

Distribution loss (46)m = 0.15 x (45)m

35.9796	31.6910	33.3197	28.4362	26.9871	23.6860	22.9052	24.1607	24.8108	28.4245	31.1553	35.4716	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

260.8447	230.2239	243.1119	209.8787	200.8948	178.2104	173.6822	182.0521	185.7092	210.4777	228.0061	257.4583	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

260.8447	230.2239	243.1119	209.8787	200.8948	178.2104	173.6822	182.0521	185.7092	210.4777	228.0061	257.4583	(64)
									Total per year (kWh/year) = Sum(64)m =		2560.5500	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

96.5394	85.4088	90.6432	79.2768	76.6061	68.7471	67.5579	70.3408	71.2404	79.7924	85.3042	95.4134	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.8367	21.1715	17.2179	13.0350	9.7438	8.2262	8.8886	11.5538	15.5075	19.6903	22.9815	24.4992	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.6450	304.7751	296.8873	280.0950	258.8978	238.9754	225.6661	222.5359	230.4238	247.2160	268.4132	288.3356	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	(71)
Water heating gains (Table 5)	129.7572	127.0964	121.8323	110.1066	102.9651	95.4820	90.8036	94.5441	98.9450	107.2478	118.4780	128.2438	(72)
Total internal gains	552.2186	550.0227	532.9171	500.2164	468.5865	439.6633	422.3380	425.6136	441.8560	471.1338	506.8524	538.0583	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	10.7700	36.7938	0.6300	0.8270	0.7700	143.0771	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	143.0771	243.7132	333.4590	413.1719	462.7869	459.4403	442.9495	405.9344	361.0656	269.3550	171.3733	122.4442	(83)
Total gains	695.2957	793.7359	866.3761	913.3882	931.3734	899.1036	865.2874	831.5480	802.9215	740.4888	678.2258	660.5025	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	117.0242	117.5982	118.1779	121.1644	121.7799	124.9536	124.9536	125.6083	123.6645	121.7799	120.5551	119.3547	
alpha	8.8016	8.8399	8.8785	9.0776	9.1187	9.3302	9.3302	9.3739	9.2443	9.1187	9.0370	8.9570	
util living area	0.7872	0.6781	0.5618	0.4347	0.3261	0.2266	0.1619	0.1752	0.2764	0.4585	0.6697	0.8112	(86)
MIT	20.9578	20.9869	20.9973	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9997	20.9908	20.9498	(87)
Th 2	20.5470	20.5491	20.5512	20.5619	20.5640	20.5746	20.5746	20.5768	20.5704	20.5640	20.5597	20.5555	(88)
util rest of house	0.7702	0.6605	0.5447	0.4190	0.3108	0.2115	0.1462	0.1590	0.2592	0.4393	0.6498	0.7949	(89)
MIT 2	20.5024	20.5358	20.5486	20.5616	20.5640	20.5746	20.5746	20.5768	20.5704	20.5637	20.5507	20.5019	(90)
Living area fraction									fLA = Living area / (4) =			0.4075	(91)
MIT	20.6880	20.7196	20.7314	20.7402	20.7416	20.7480	20.7480	20.7492	20.7454	20.7414	20.7300	20.6844	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6880	20.7196	20.7314	20.7402	20.7416	20.7480	20.7480	20.7492	20.7454	20.7414	20.7300	20.6844	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7756	0.6672	0.5516	0.4254	0.3171	0.2177	0.1526	0.1656	0.2662	0.4471	0.6575	0.7997	(94)
Useful gains	539.2405	529.5966	477.8566	388.5732	295.2978	195.6948	132.0332	137.7180	213.7342	331.1017	445.9274	528.2157	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	556.9888	535.0469	478.9702	388.6688	295.3035	195.6949	132.0332	137.7180	213.7349	331.2210	449.6838	549.3278	(97)
Space heating kWh	13.2047	3.6626	0.8285	0.0688	0.0042	0.0000	0.0000	0.0000	0.0000	0.0888	2.7046	15.7074	(98a)
Space heating requirement - total per year (kWh/year)												36.2696	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	13.2047	3.6626	0.8285	0.0688	0.0042	0.0000	0.0000	0.0000	0.0000	0.0888	2.7046	15.7074	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												36.2696	
Space heating per m2										(98c) / (4) =		0.5032	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	13.2047	3.6626	0.8285	0.0688	0.0042	0.0000	0.0000	0.0000	0.0000	0.0888	2.7046	15.7074	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	13.2047	3.6626	0.8285	0.0688	0.0042	0.0000	0.0000	0.0000	0.0000	0.0888	2.7046	15.7074	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	260.8447	230.2239	243.1119	209.8787	200.8948	178.2104	173.6822	182.0521	185.7092	210.4777	228.0061	257.4583	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	260.8447	230.2239	243.1119	209.8787	200.8948	178.2104	173.6822	182.0521	185.7092	210.4777	228.0061	257.4583	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.3002	12.0131	13.3002	12.8712	13.3002	12.8712	13.3002	13.3002	12.8712	13.3002	12.8712	13.3002	(231)
Lighting	20.8641	16.7380	15.0707	11.0414	8.5287	6.9680	7.7802	10.1130	13.1358	17.2348	19.4667	21.4440	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.9291	-26.8464	-43.6554	-55.0679	-64.6967	-62.2591	-61.2682	-55.3254	-45.2257	-33.0107	-19.5434	-14.2765	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.5687	-8.2932	-18.2691	-30.2794	-42.3016	-43.4549	-42.8389	-34.6881	-23.6972	-12.5148	-4.9640	-2.7406	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												36.2696	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2560.5500	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	156.5993	(230a)
Total electricity for the above, kWh/year	156.5993	(231)
Electricity for lighting (calculated in Appendix L)	168.3854	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-765.7149	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2156.0893	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	36.2696	16.4900	5.9809	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2560.5500	16.4900	422.2347	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	156.5993	16.4900	25.8232	(249)
Energy for lighting	168.3854	16.4900	27.7667	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.1044	16.4900	-82.1374	
PV Unit electricity exported	-267.6105	5.5900	-14.9594	
Total			-97.0968	(252)
Total energy cost			384.7087	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1829	(257)
SAP value		80.8250	
SAP rating (Section 12)		81	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	36.2696	0.1615	5.8563	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2560.5500	0.1413	361.8103	(264)
Space and water heating			367.6666	(265)
Pumps, fans and electric keep-hot	156.5993	0.1387	21.7223	(267)
Energy for lighting	168.3854	0.1443	24.3032	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.1044	0.1323	-65.9022	
PV Unit electricity exported	-267.6105	0.1235	-33.0479	
Total			-98.9501	(269)
Total CO2, kg/year			314.7420	(272)
CO2 emissions per m2			4.3700	(273)
EI value			96.3977	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		72.0800 (1b)	x	2.4000 (2b)	=	172.9920	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	172.9920	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.7700	1.2357	13.3089			(27)
External Wall 1	22.8100	10.7700	12.0400	0.1400	1.6856	14.0000	168.5600	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	14.9945			(33)
Party Wall 1			54.3800	0.0000	0.0000	20.0000	1087.6000	(32)
Wall to corridor			14.8800	0.0000	0.0000	20.0000	297.6000	(32)
Party Floor 1			72.0800			80.0000	5766.4000	(32d)
Party Ceiling 1			72.0800			80.0000	5766.4000	(32b)
Internal Wall 1			136.8900			9.0000	1232.0100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14318.5700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		198.6483 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	4.6400	0.0500	0.2320
E4 Jamb	27.8400	0.0500	1.3920
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		2.5395 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	17.5340 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.6196	16.6196	16.2877	15.2923	15.1264	14.4627	14.1309	14.1309	14.7945	15.6241	15.9559	15.7900	(38)
Heat transfer coeff	34.1536	34.1536	33.8218	32.8263	32.6604	31.9968	31.6649	31.6649	32.3286	33.1581	33.4900	33.3240	(39)
Average = Sum(39)m / 12 =												32.9369	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4738	0.4738	0.4692	0.4554	0.4531	0.4439	0.4393	0.4393	0.4485	0.4600	0.4646	0.4623	(40)
HLP (average)												0.4569	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.2955 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
86.2240	84.9283	83.0401	79.4273	76.7612	73.7880	72.0980	73.9719	76.0261	79.2184	82.9088	85.8937	(42a)

Hot water usage for baths

27.0899	26.6876	26.1210	25.0764	24.2942	23.4268	22.9583	23.5209	24.1335	25.0616	26.1277	26.9983	(42b)

Hot water usage for other uses

38.1387	36.7518	35.3650	33.9781	32.5912	31.2044	31.2044	32.5912	33.9781	35.3650	36.7518	38.1387	(42c)

Average daily hot water use (litres/day)	139.2838 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.4526	148.3676	144.5260	138.4818	133.6466	128.4192	126.2607	130.0841	134.1377	139.6450	145.7883	151.0307	(44)
Energy conte	239.8639	211.2735	222.1311	189.5747	179.9140	157.9064	152.7014	161.0713	165.4052	189.4969	207.7021	236.4775	(45)
Energy content (annual)										Total = Sum(45)m =		2313.5180	

Distribution loss (46)m = 0.15 x (45)m

35.9796	31.6910	33.3197	28.4362	26.9871	23.6860	22.9052	24.1607	24.8108	28.4245	31.1553	35.4716	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

260.8447	230.2239	243.1119	209.8787	200.8948	178.2104	173.6822	182.0521	185.7092	210.4777	228.0061	257.4583	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	260.8447	230.2239	243.1119	209.8787	200.8948	178.2104	173.6822	182.0521	185.7092	210.4777	228.0061	257.4583	(64)
									Total per year (kWh/year) = Sum(64)m =			2560.5500	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	96.5394	85.4088	90.6432	79.2768	76.6061	68.7471	67.5579	70.3408	71.2404	79.7924	85.3042	95.4134	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.8367	21.1715	17.2179	13.0350	9.7438	8.2262	8.8886	11.5538	15.5075	19.6903	22.9815	24.4992	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.6450	304.7751	296.8873	280.0950	258.8978	238.9754	225.6661	222.5359	230.4238	247.2160	268.4132	288.3356	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	(71)
Water heating gains (Table 5)	129.7572	127.0964	121.8323	110.1066	102.9651	95.4820	90.8036	94.5441	98.9450	107.2478	118.4780	128.2438	(72)
Total internal gains	552.2186	550.0227	532.9171	500.2164	468.5865	439.6633	422.3380	425.6136	441.8560	471.1338	506.8524	538.0583	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	10.7700	33.4622	0.6300	0.8270	0.7700	130.1217	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	130.1217	236.5633	338.2708	440.8830	488.8258	471.6574	460.3741	410.2716	362.9956	259.8861	160.1724	113.8804	(83)
Total gains	682.3403	786.5860	871.1879	941.0994	957.4123	911.3207	882.7121	835.8852	804.8516	731.0199	667.0249	651.9387	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	116.4557	116.4557	117.5982	121.1644	121.7799	124.3057	125.6083	125.6083	123.0299	119.9519	118.7634	119.3547	
alpha	8.7637	8.7637	8.8399	9.0776	9.1187	9.2870	9.3739	9.3739	9.2020	8.9968	8.9176	8.9570	
util living area	0.8155	0.7127	0.5953	0.4567	0.3513	0.2739	0.2188	0.2349	0.3294	0.5119	0.7114	0.8361	(86)
MIT	20.9426	20.9796	20.9953	20.9996	21.0000	21.0000	21.0000	21.0000	21.0000	20.9991	20.9839	20.9344	(87)
Th 2	20.5449	20.5449	20.5491	20.5619	20.5640	20.5725	20.5768	20.5768	20.5683	20.5576	20.5534	20.5555	(88)
util rest of house	0.7994	0.6953	0.5784	0.4415	0.3365	0.2589	0.2036	0.2188	0.3120	0.4921	0.6915	0.8210	(89)
MIT 2	20.4834	20.5237	20.5445	20.5615	20.5640	20.5725	20.5768	20.5768	20.5682	20.5568	20.5372	20.4846	(90)
Living area fraction										fLA = Living area / (4) =		0.4075	(91)
MIT	20.6705	20.7095	20.7282	20.7400	20.7416	20.7467	20.7492	20.7492	20.7442	20.7370	20.7192	20.6679	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6705	20.7095	20.7282	20.7400	20.7416	20.7467	20.7492	20.7492	20.7442	20.7370	20.7192	20.6679	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8039	0.7016	0.5851	0.4477	0.3425	0.2650	0.2098	0.2254	0.3191	0.5001	0.6990	0.8249	(94)
Useful gains	548.5519	551.8680	509.7401	421.3315	327.9511	241.4691	185.2153	188.3818	256.8188	365.6040	466.2314	537.7691	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	572.7731	560.4418	511.6622	421.4901	327.9634	241.4699	185.2154	188.3819	256.8235	365.9661	472.8521	565.4381	(97)
Space heating kWh	18.0206	5.7616	1.4300	0.1142	0.0092	0.0000	0.0000	0.0000	0.0000	0.2694	4.7669	20.5857	(98a)
Space heating requirement - total per year (kWh/year)												50.9576	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	18.0206	5.7616	1.4300	0.1142	0.0092	0.0000	0.0000	0.0000	0.0000	0.2694	4.7669	20.5857	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												50.9576	
Space heating per m2											(98c) / (4) =	0.7070	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	18.0206	5.7616	1.4300	0.1142	0.0092	0.0000	0.0000	0.0000	0.0000	0.2694	4.7669	20.5857	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													

	18.0206	5.7616	1.4300	0.1142	0.0092	0.0000	0.0000	0.0000	0.0000	0.2694	4.7669	20.5857 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	260.8447	230.2239	243.1119	209.8787	200.8948	178.2104	173.6822	182.0521	185.7092	210.4777	228.0061	257.4583 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	260.8447	230.2239	243.1119	209.8787	200.8948	178.2104	173.6822	182.0521	185.7092	210.4777	228.0061	257.4583 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	13.3002	12.0131	13.3002	12.8712	13.3002	12.8712	13.3002	13.3002	12.8712	13.3002	12.8712	13.3002 (231)
Lighting	20.8641	16.7380	15.0707	11.0414	8.5287	6.9680	7.7802	10.1130	13.1358	17.2348	19.4667	21.4440 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-15.3441	-25.8360	-43.6523	-57.3837	-66.9624	-63.1589	-62.6788	-55.3422	-44.9287	-31.6294	-18.1738	-13.1999 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-3.0274	-7.7549	-18.2510	-32.6323	-45.1312	-44.6592	-44.7399	-34.7076	-23.4182	-11.6284	-4.3934	-2.4025 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	50.9576 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2560.5500 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	156.5993 (230a)
Total electricity for the above, kWh/year	156.5993 (231)
Electricity for lighting (calculated in Appendix L)	168.3854 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-771.0360 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2165.4562 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	50.9576	25.1600	12.8209	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2560.5500	25.1600	644.2344	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	156.5993	25.1600	39.4004	(249)
Energy for lighting	168.3854	25.1600	42.3658	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.2900	25.1600	-125.3698	
PV Unit electricity exported	-272.7460	5.8100	-15.8465	
Total			-141.2163	(252)
Total energy cost			597.6051	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	50.9576	0.1611	8.2075	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2560.5500	0.1413	361.8103	(264)
Space and water heating			370.0178	(265)
Pumps, fans and electric keep-hot	156.5993	0.1387	21.7223	(267)
Energy for lighting	168.3854	0.1443	24.3032	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.2900	0.1320	-65.7720	
PV Unit electricity exported	-272.7460	0.1230	-33.5496	
Total			-99.3216	(269)
Total CO2, kg/year			316.7216	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	50.9576	1.5960	81.3293	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2560.5500	1.5225	3898.4448	(278)
Space and water heating			3979.7741	(279)

Pumps, fans and electric keep-hot	156.5993	1.5128	236.9034 (281)
Energy for lighting	168.3854	1.5338	258.2751 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-498.2900	1.4877	-741.3020
PV Unit electricity exported	-272.7460	0.4514	-123.1271
Total			-864.4291 (283)
Total Primary energy kWh/year			3610.5235 (286)

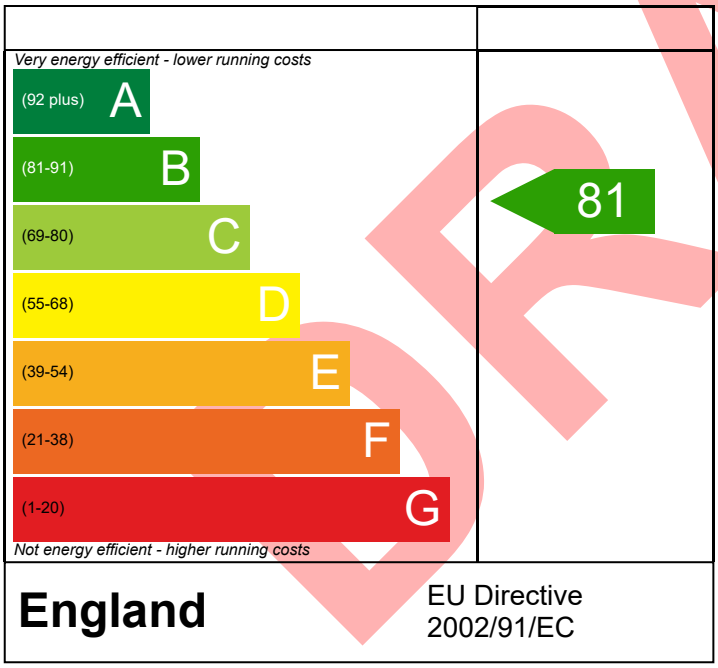
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	72.08 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

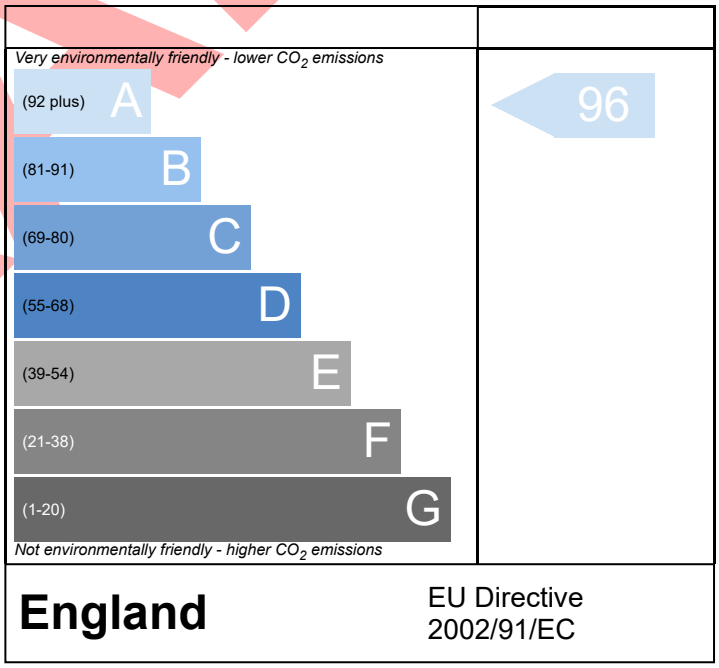
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:21

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	66 m^2
Site Reference	Unit 122 L06_Copy	Plot Reference	Unit 122 L06_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*10.77 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	5.06 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*58.19 kWh_{PE}/m^2*	
Dwelling primary energy	56.83 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*19.7 kWh/m^2*	
Dwelling fabric energy efficiency	18.7 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	25.95	0.14 **(!)**
Party wall: Party Wall (1)	55.93	0 **(!)**
Party wall: Party Wall (2)	3.85	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	7.18	South West	0.83	1.3
SE, Opening Type 1	10.77	South East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.86 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 122 L06_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 122 L06_Copy	**Prop Type Ref**	Unit 122 L06
Property			

SAP Rating	79 C	**DER**	5.06	**TER**	10.77
Environmental	96 A	**% DER < TER**			53.02
CO_2 Emissions (t/year)	0.34	**DFEE**	18.75	**TFEE**	19.70
Compliance Check	See BREL	**% DFEE < TFEE**			4.82
% DPER < TPER	2.33	**DPER**	56.83	**TPER**	58.19

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.5000 (1b)	x	2.4000 (2b)	=	159.6000	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.5000					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.6000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			17.9500	1.2357	22.1816			(27)
External Wall 1	43.9000	17.9500	25.9500	0.1400	3.6330	14.0000	363.3000	(29a)
Total net area of external elements Aum(A, m2)			43.9000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.8146			(33)
Party Wall 1			55.9300	0.0000	0.0000	20.0000	1118.6000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.5000			80.0000	5320.0000	(32d)
Party Ceiling 1			66.5000			80.0000	5320.0000	(32b)
Internal Wall 1			140.2900			9.0000	1262.6100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13461.5100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.4287 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	7.7300	0.0500	0.3865

E4 Jamb	23.2000	0.0500	1.1600	
E7 Party floor between dwellings (in blocks of flats)	32.5200	0.0700	2.2764	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	44.2800	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.1469 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 29.9615 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.9354	15.7675	15.5996	14.7602	14.5923	13.7529	13.7529	13.5851	14.0887	14.5923	14.9281	15.2638	(38)
Heat transfer coeff	45.8968	45.7289	45.5611	44.7217	44.5538	43.7144	43.7144	43.5465	44.0501	44.5538	44.8895	45.2253	(39)

Average = Sum(39)m / 12 = 44.6797

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6902	0.6877	0.6851	0.6725	0.6700	0.6574	0.6574	0.6548	0.6624	0.6700	0.6750	0.6801	(40)
HLP (average)												0.6719	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1583 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	83.0588	81.8106	79.9917	76.5116	73.9433	71.0793	69.4513	71.2564	73.2352	76.3103	79.8652	82.7406	(42a)
Hot water usage for baths	26.1000	25.7123	25.1665	24.1600	23.4064	22.5708	22.1194	22.6614	23.2516	24.1458	25.1729	26.0117	(42b)
Hot water usage for other uses	36.7327	35.3969	34.0612	32.7255	31.3897	30.0540	30.0540	31.3897	32.7255	34.0612	35.3969	36.7327	(42c)

Average daily hot water use (litres/day) 134.1695 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.8914	142.9198	139.2194	133.3971	128.7395	123.7040	121.6247	125.3076	129.2122	134.5173	140.4351	145.4849	(44)
Energy conte	231.0563	203.5159	213.9750	182.6139	173.3081	152.1085	147.0945	155.1570	159.3316	182.5387	200.0755	227.7943	(45)

Energy content (annual) Total = Sum(45)m = 2228.5693

Distribution loss (46)m = 0.15 x (45)m	34.6584	30.5274	32.0962	27.3921	25.9962	22.8163	22.0642	23.2735	23.8997	27.3808	30.0113	34.1691	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)

Total per year (kWh/year) = Sum(64)m = 2475.6013 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	93.6109	82.8294	87.9313	76.9623	74.4096	66.8193	65.6936	68.3743	69.2210	77.4788	82.7683	92.5262	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7552	19.3227	15.7143	11.8967	8.8930	7.5078	8.1125	10.5449	14.1533	17.9709	20.9747	22.3598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	282.0814	285.0085	277.6323	261.9291	242.1067	223.4764	211.0302	208.1031	215.4793	231.1825	251.0049	269.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	(71)
Water heating gains (Table 5)	125.8211	123.2580	118.1873	106.8921	100.0129	92.8046	88.2978	91.9010	96.1402	104.1381	114.9560	124.3632	(72)
Total internal gains	522.9304	520.8621	504.8066	473.9908	444.2853	417.0615	400.7133	403.8217	419.0457	446.5643	480.2084	509.6310	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	10.7700	36.7938	0.6300	0.8270	0.7700	143.0771	(77)
Southwest	7.1800	36.7938	0.6300	0.8270	0.7700	95.3847	(79)

Solar gains	238.4618	406.1886	555.7650	688.6198	771.3115	765.7338	738.2491	676.5573	601.7760	448.9250	285.6222	204.0736	(83)
Total gains	761.3922	927.0507	1060.5716	1162.6105	1215.5968	1182.7954	1138.9624	1080.3791	1020.8216	895.4892	765.8306	713.7046	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	81.4721	81.7712	82.0725	83.6129	83.9280	85.5395	85.5395	85.8693	84.8875	83.9280	83.3002	82.6818	
alpha	6.4315	6.4514	6.4715	6.5742	6.5952	6.7026	6.7026	6.7246	6.6592	6.5952	6.5533	6.5121	
util living area	0.8683	0.7491	0.6116	0.4638	0.3407	0.2365	0.1689	0.1854	0.2977	0.5142	0.7647	0.8924	(86)
MIT	20.7782	20.9120	20.9747	20.9960	20.9995	21.0000	21.0000	21.0000	20.9999	20.9938	20.9190	20.7407	(87)
Th 2	20.3495	20.3518	20.3540	20.3652	20.3674	20.3787	20.3787	20.3809	20.3742	20.3674	20.3629	20.3585	(88)
util rest of house	0.8507	0.7260	0.5866	0.4399	0.3176	0.2136	0.1450	0.1605	0.2707	0.4838	0.7383	0.8769	(89)
MIT 2	20.1094	20.2610	20.3294	20.3616	20.3671	20.3786	20.3786	20.3809	20.3741	20.3622	20.2818	20.0744	(90)
Living area fraction									fLA = Living area / (4) =			0.3370	(91)
MIT	20.3348	20.4804	20.5469	20.5754	20.5802	20.5880	20.5880	20.5895	20.5850	20.5751	20.4966	20.2989	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3348	20.4804	20.5469	20.5754	20.5802	20.5880	20.5880	20.5895	20.5850	20.5751	20.4966	20.2989	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8503	0.7307	0.5941	0.4478	0.3253	0.2213	0.1531	0.1689	0.2798	0.4938	0.7440	0.8754	(94)
Useful gains	647.4005	677.3634	630.1071	520.6484	395.4834	261.7543	174.3342	182.4384	285.6205	442.2110	569.7953	624.7518	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	735.9457	712.4747	639.9914	522.1425	395.6461	261.7626	174.3347	182.4394	285.6632	444.4263	601.3654	728.0791	(97)
Space heating kWh	65.8776	23.5948	7.3539	1.0757	0.1210	0.0000	0.0000	0.0000	0.0000	1.6482	22.7305	76.8755	(98a)
Space heating requirement - total per year (kWh/year)												199.2773	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	65.8776	23.5948	7.3539	1.0757	0.1210	0.0000	0.0000	0.0000	0.0000	1.6482	22.7305	76.8755	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												199.2773	
Space heating per m2											(98c) / (4) =	2.9967	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 100.0000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	65.8776	23.5948	7.3539	1.0757	0.1210	0.0000	0.0000	0.0000	0.0000	1.6482	22.7305	76.8755	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	65.8776	23.5948	7.3539	1.0757	0.1210	0.0000	0.0000	0.0000	0.0000	1.6482	22.7305	76.8755	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5760	10.4558	11.5760	11.2026	11.5760	11.2026	11.5760	11.5760	11.2026	11.5760	11.2026	11.5760	(231)
Lighting	19.0422	15.2763	13.7546	10.0772	7.7840	6.3596	7.1008	9.2299	11.9887	15.7298	17.7668	19.5714	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.8391	-25.0585	-40.6536	-51.2456	-60.2346	-57.9825	-57.0592	-51.4970	-42.0573	-30.6751	-18.2170	-13.3635	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.1159	-7.4362	-16.6099	-27.6777	-38.7100	-39.7745	-39.2119	-31.7414	-21.6778	-11.4238	-4.4458	-2.3728	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year
Space heating fuel - main system 1 199.2773 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 100.0000
Water heating fuel used 2475.6013 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)
mechanical ventilation fans (SFP = 0.7000) 136.2984 (230a)
Total electricity for the above, kWh/year 136.2984 (231)
Electricity for lighting (calculated in Appendix L) 153.6812 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation -708.0805 (233)
Wind generation 0.0000 (234)
Hydro-electric generation (Appendix N) 0.0000 (235a)
Electricity generated - Micro CHP (Appendix N) 0.0000 (235)

Appendix Q - special features

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2256.7778	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	199.2773	16.4900	32.8608	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	16.4900	408.2267	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	136.2984	16.4900	22.4756	(249)
Energy for lighting	153.6812	16.4900	25.3420	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-463.8828	16.4900	-76.4943	
PV Unit electricity exported	-244.1976	5.5900	-13.6506	
Total			-90.1449	(252)
Total energy cost			398.7602	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2875	(257)
SAP value	79.1300	
SAP rating (Section 12)	79	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	199.2773	0.1606	31.9953	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2475.6013	0.1413	349.7834	(264)
Space and water heating			381.7788	(265)
Pumps, fans and electric keep-hot	136.2984	0.1387	18.9063	(267)
Energy for lighting	153.6812	0.1443	22.1809	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-463.8828	0.1323	-61.3812	
PV Unit electricity exported	-244.1976	0.1233	-30.1140	
Total			-91.4951	(269)
Total CO2, kg/year			331.3709	(272)
CO2 emissions per m2			4.9800	(273)
EI value			96.0176	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.5000	(1b)	x 2.4000	(2b) =	159.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 66.5000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		159.6000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor (20) = 1 - [0.075 x (19)] =		0.8500	(20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			17.9500	1.2357	22.1816			(27)
External Wall 1	43.9000	17.9500	25.9500	0.1400	3.6330	14.0000	363.3000	(29a)
Total net area of external elements Aum(A, m2)			43.9000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.8146			(33)
Party Wall 1			55.9300	0.0000	0.0000	20.0000	1118.6000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.5000			80.0000	5320.0000	(32d)
Party Ceiling 1			66.5000			80.0000	5320.0000	(32b)
Internal Wall 1			140.2900			9.0000	1262.6100	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13461.5100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 202.4287 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	7.7300	0.0500	0.3865
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	32.5200	0.0700	2.2764
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	44.2800	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.1469 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 29.9615 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.1032	16.1032	15.7675	14.7602	14.5923	13.9208	13.5851	13.5851	14.2566	15.0960	15.4317	15.2638	(38)
Heat transfer coeff	46.0647	46.0647	45.7289	44.7217	44.5538	43.8823	43.5465	43.5465	44.2180	45.0574	45.3932	45.2253	(39)
Average = Sum(39)m / 12 =												44.8336	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6927	0.6927	0.6877	0.6725	0.6700	0.6599	0.6548	0.6548	0.6649	0.6776	0.6826	0.6801	(40)
HLP (average)												0.6742	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1583 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	83.0588	81.8106	79.9917	76.5116	73.9433	71.0793	69.4513	71.2564	73.2352	76.3103	79.8652	82.7406	(42a)
Hot water usage for baths	26.1000	25.7123	25.1665	24.1600	23.4064	22.5708	22.1194	22.6614	23.2516	24.1458	25.1729	26.0117	(42b)
Hot water usage for other uses	36.7327	35.3969	34.0612	32.7255	31.3897	30.0540	30.0540	31.3897	32.7255	34.0612	35.3969	36.7327	(42c)
Average daily hot water use (litres/day)												134.1695	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.8914	142.9198	139.2194	133.3971	128.7395	123.7040	121.6247	125.3076	129.2122	134.5173	140.4351	145.4849	(44)
Energy conte	231.0563	203.5159	213.9750	182.6139	173.3081	152.1085	147.0945	155.1570	159.3316	182.5387	200.0755	227.7943	(45)
Energy content (annual)										Total = Sum(45)m =		2228.5693	
Distribution loss (46)m = 0.15 x (45)m	34.6584	30.5274	32.0962	27.3921	25.9962	22.8163	22.0642	23.2735	23.8997	27.3808	30.0113	34.1691	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
									Total per year (kWh/year) = Sum(64)m =			2475.6013	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)

Heat gains from water heating, kWh/month

	93.6109	82.8294	87.9313	76.9623	74.4096	66.8193	65.6936	68.3743	69.2210	77.4788	82.7683	92.5262	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.7552	19.3227	15.7143	11.8967	8.8930	7.5078	8.1125	10.5449	14.1533	17.9709	20.9747	22.3598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	282.0814	285.0085	277.6323	261.9291	242.1067	223.4764	211.0302	208.1031	215.4793	231.1825	251.0049	269.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	(71)
Water heating gains (Table 5)													
	125.8211	123.2580	118.1873	106.8921	100.0129	92.8046	88.2978	91.9010	96.1402	104.1381	114.9560	124.3632	(72)
Total internal gains													
	522.9304	520.8621	504.8066	473.9908	444.2853	417.0615	400.7133	403.8217	419.0457	446.5643	480.2084	509.6310	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	10.7700	33.4622	0.6300	0.8270	0.7700	130.1217	(77)
Southwest	7.1800	33.4622	0.6300	0.8270	0.7700	86.7478	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	216.8696	394.2722	563.7846	734.8050	814.7097	786.0956	767.2902	683.7861	604.9927	433.1436	266.9540	189.8007	(83)
Total gains	739.8000	915.1343	1068.5913	1208.7958	1258.9950	1203.1571	1168.0034	1087.6078	1024.0384	879.7078	747.1624	699.4317	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	81.1751	81.1751	81.7712	83.6129	83.9280	85.2123	85.8693	85.8693	84.5652	82.9898	82.3760	82.6818	
alpha	6.4117	6.4117	6.4514	6.5742	6.5952	6.6808	6.7246	6.7246	6.6377	6.5327	6.4917	6.5121	
util living area													
	0.8906	0.7798	0.6431	0.4825	0.3642	0.2844	0.2274	0.2482	0.3538	0.5718	0.8022	0.9102	(86)
MIT	20.7290	20.8829	20.9641	20.9945	20.9992	20.9999	21.0000	21.0000	20.9995	20.9871	20.8855	20.6924	(87)
Th 2	20.3473	20.3473	20.3518	20.3652	20.3674	20.3764	20.3809	20.3809	20.3719	20.3607	20.3562	20.3585	(88)
util rest of house													
	0.8752	0.7580	0.6189	0.4596	0.3419	0.2617	0.2043	0.2234	0.3268	0.5412	0.7778	0.8968	(89)
MIT 2	20.0498	20.2245	20.3160	20.3601	20.3668	20.3763	20.3809	20.3809	20.3715	20.3492	20.2391	20.0170	(90)
Living area fraction									fLA = Living area / (4) =			0.3370	(91)
MIT	20.2787	20.4464	20.5344	20.5739	20.5799	20.5865	20.5895	20.5895	20.5832	20.5642	20.4569	20.2446	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2787	20.4464	20.5344	20.5739	20.5799	20.5865	20.5895	20.5895	20.5832	20.5642	20.4569	20.2446	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8734	0.7614	0.6258	0.4672	0.3494	0.2694	0.2121	0.2318	0.3359	0.5510	0.7818	0.8942	(94)
Useful gains	646.1594	696.8174	668.7070	564.7212	439.9070	324.0974	247.7528	252.1023	343.9917	484.7375	584.1080	625.4624	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	754.4802	743.7771	682.9348	566.7990	440.1869	324.1345	247.7586	252.1127	344.1560	489.5121	629.0109	748.2347	(97)
Space heating kWh													
	80.5907	31.5569	10.5855	1.4960	0.2082	0.0000	0.0000	0.0000	0.0000	3.5523	32.3301	91.3425	(98a)
Space heating requirement - total per year (kWh/year)												251.6622	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	80.5907	31.5569	10.5855	1.4960	0.2082	0.0000	0.0000	0.0000	0.0000	3.5523	32.3301	91.3425	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												251.6622	
Space heating per m2										(98c) / (4) =		3.7844	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	80.5907	31.5569	10.5855	1.4960	0.2082	0.0000	0.0000	0.0000	0.0000	3.5523	32.3301	91.3425	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	80.5907	31.5569	10.5855	1.4960	0.2082	0.0000	0.0000	0.0000	0.0000	3.5523	32.3301	91.3425	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(219)
Space cooling fuel requirement													

(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5760	10.4558	11.5760	11.2026	11.5760	11.2026	11.5760	11.5760	11.2026	11.5760	11.2026	11.5760	(231)
Lighting	19.0422	15.2763	13.7546	10.0772	7.7840	6.3596	7.1008	9.2299	11.9887	15.7298	17.7668	19.5714	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.3667	-24.1477	-40.6887	-53.4206	-62.3575	-58.8247	-58.3796	-51.5126	-41.7801	-29.4067	-16.9631	-12.3641	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.6220	-6.9149	-16.5552	-29.8200	-41.2989	-40.8780	-40.9539	-31.7592	-21.4223	-10.5951	-3.9054	-2.0639	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	251.6622	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2475.6013	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.2984	(230a)
Total electricity for the above, kWh/year	136.2984	(231)
Electricity for lighting (calculated in Appendix L)	153.6812	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-713.0011	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2304.2421	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	251.6622	25.1600	63.3182	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	25.1600	622.8613	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	136.2984	25.1600	34.2927	(249)
Energy for lighting	153.6812	25.1600	38.6662	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.2121	25.1600	-116.7958	
PV Unit electricity exported	-248.7890	5.8100	-14.4546	
Total			-131.2504	(252)
Total energy cost			627.8880	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	251.6622	0.1601	40.3002	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2475.6013	0.1413	349.7834	(264)
Space and water heating			390.0836	(265)
Pumps, fans and electric keep-hot	136.2984	0.1387	18.9063	(267)
Energy for lighting	153.6812	0.1443	22.1809	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.2121	0.1320	-61.2829	
PV Unit electricity exported	-248.7890	0.1228	-30.5546	
Total			-91.8374	(269)
Total CO2, kg/year			339.3334	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	251.6622	1.5926	400.7994	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	1.5225	3769.0221	(278)
Space and water heating			4169.8215	(279)
Pumps, fans and electric keep-hot	136.2984	1.5128	206.1922	(281)
Energy for lighting	153.6812	1.5338	235.7213	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.2121	1.4878	-690.6382	
PV Unit electricity exported	-248.7890	0.4507	-112.1351	
Total			-802.7733	(283)
Total Primary energy kWh/year			3808.9617	(286)

SAP 10 EPC IMPROVEMENTS

Unit 122 L06_Copy

Current energy efficiency rating: C 79
Current environmental impact rating: A 96

N Solar water heating — Not applicable
U Solar photovoltaic panels — Not applicable
V2 Wind turbine — Not applicable

Recommended measures: SAP change | Cost change | CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 79
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£759	£759	£0
Space heating	£98	£98	£0
Water heating	£623	£623	£0
Lighting	£39	£39	£0
Generated (PV)	-£131	-£131	£0
Total cost of fuels	£628	£628	£0
Total cost of uses	£629	£629	£0
Delivered energy	35 kWh/m²	35 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	57 kWh/m²	57 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.5000 (1b)	x	2.4000 (2b)	=	159.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.6000	(5)

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2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation: 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a): 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			17.9500	1.2357	22.1816			(27)
External Wall 1	43.9000	17.9500	25.9500	0.1400	3.6330	14.0000	363.3000	(29a)
Total net area of external elements Aum(A, m2)			43.9000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.8146			(33)
Party Wall 1			55.9300	0.0000	0.0000	20.0000	1118.6000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.5000			80.0000	5320.0000	(32d)
Party Ceiling 1			66.5000			80.0000	5320.0000	(32b)
Internal Wall 1			140.2900			9.0000	1262.6100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13461.5100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.4287 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	7.7300	0.0500	0.3865
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	32.5200	0.0700	2.2764
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	44.2800	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.1469 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	29.9615 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.9354	15.7675	15.5996	14.7602	14.5923	13.7529	13.7529	13.5851	14.0887	14.5923	14.9281	15.2638	(38)
Heat transfer coeff	45.8968	45.7289	45.5611	44.7217	44.5538	43.7144	43.7144	43.5465	44.0501	44.5538	44.8895	45.2253	(39)
Average = Sum(39)m / 12 =												44.6797	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6902	0.6877	0.6851	0.6725	0.6700	0.6574	0.6574	0.6548	0.6624	0.6700	0.6750	0.6801	(40)
HLP (average)												0.6719	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1583	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
83.0588	81.8106	79.9917	76.5116	73.9433	71.0793	69.4513	71.2564	73.2352	76.3103	79.8652	82.7406	(42a)

Hot water usage for baths

26.1000	25.7123	25.1665	24.1600	23.4064	22.5708	22.1194	22.6614	23.2516	24.1458	25.1729	26.0117	(42b)

Hot water usage for other uses

36.7327	35.3969	34.0612	32.7255	31.3897	30.0540	30.0540	31.3897	32.7255	34.0612	35.3969	36.7327	(42c)

Average daily hot water use (litres/day)	134.1695	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.8914	142.9198	139.2194	133.3971	128.7395	123.7040	121.6247	125.3076	129.2122	134.5173	140.4351	145.4849	(44)
Energy conte	231.0563	203.5159	213.9750	182.6139	173.3081	152.1085	147.0945	155.1570	159.3316	182.5387	200.0755	227.7943	(45)
Energy content (annual)										Total = Sum(45)m =		2228.5693	

Distribution loss (46)m = 0.15 x (45)m

34.6584	30.5274	32.0962	27.3921	25.9962	22.8163	22.0642	23.2735	23.8997	27.3808	30.0113	34.1691	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
								Total per year (kWh/year) = Sum(64)m =			2475.6013	(64)
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month													
93.6109	82.8294	87.9313	76.9623	74.4096	66.8193	65.6936	68.3743	69.2210	77.4788	82.7683	92.5262	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
21.7552	19.3227	15.7143	11.8967	8.8930	7.5078	8.1125	10.5449	14.1533	17.9709	20.9747	22.3598	(67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
282.0814	285.0085	277.6323	261.9291	242.1067	223.4764	211.0302	208.1031	215.4793	231.1825	251.0049	269.6352	(68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	(69)	
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)													
-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	(71)	
Water heating gains (Table 5)													
125.8211	123.2580	118.1873	106.8921	100.0129	92.8046	88.2978	91.9010	96.1402	104.1381	114.9560	124.3632	(72)	
Total internal gains													
522.9304	520.8621	504.8066	473.9908	444.2853	417.0615	400.7133	403.8217	419.0457	446.5643	480.2084	509.6310	(73)	

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	10.7700	36.7938	0.6300	0.8270	0.7700	143.0771	(77)
Southwest	7.1800	36.7938	0.6300	0.8270	0.7700	95.3847	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	238.4618	406.1886	555.7650	688.6198	771.3115	765.7338	738.2491	676.5573	601.7760	448.9250	285.6222	204.0736	(83)
Total gains	761.3922	927.0507	1060.5716	1162.6105	1215.5968	1182.7954	1138.9624	1080.3791	1020.8216	895.4892	765.8306	713.7046	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	81.4721	81.7712	82.0725	83.6129	83.9280	85.5395	85.5395	85.8693	84.8875	83.9280	83.3002	82.6818	
alpha	6.4315	6.4514	6.4715	6.5742	6.5952	6.7026	6.7026	6.7246	6.6592	6.5952	6.5533	6.5121	
util living area	0.8683	0.7491	0.6116	0.4638	0.3407	0.2365	0.1689	0.1854	0.2977	0.5142	0.7647	0.8924	(86)
MIT	20.7782	20.9120	20.9747	20.9960	20.9995	21.0000	21.0000	21.0000	20.9999	20.9938	20.9190	20.7407	(87)
Th 2	20.3495	20.3518	20.3540	20.3652	20.3674	20.3787	20.3787	20.3809	20.3742	20.3674	20.3629	20.3585	(88)
util rest of house	0.8507	0.7260	0.5866	0.4399	0.3176	0.2136	0.1450	0.1605	0.2707	0.4838	0.7383	0.8769	(89)
MIT 2	20.1094	20.2610	20.3294	20.3616	20.3671	20.3786	20.3786	20.3809	20.3741	20.3622	20.2818	20.0744	(90)
Living area fraction									fLA = Living area / (4) =			0.3370	(91)
MIT	20.3348	20.4804	20.5469	20.5754	20.5802	20.5880	20.5880	20.5895	20.5850	20.5751	20.4966	20.2989	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3348	20.4804	20.5469	20.5754	20.5802	20.5880	20.5880	20.5895	20.5850	20.5751	20.4966	20.2989	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8503	0.7307	0.5941	0.4478	0.3253	0.2213	0.1531	0.1689	0.2798	0.4938	0.7440	0.8754	(94)
Useful gains	647.4005	677.3634	630.1071	520.6484	395.4834	261.7543	174.3342	182.4384	285.6205	442.2110	569.7953	624.7518	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	735.9457	712.4747	639.9914	522.1425	395.6461	261.7626	174.3347	182.4394	285.6632	444.4263	601.3654	728.0791	(97)
Space heating kWh	65.8776	23.5948	7.3539	1.0757	0.1210	0.0000	0.0000	0.0000	0.0000	1.6482	22.7305	76.8755	(98a)
Space heating requirement - total per year (kWh/year)												199.2773	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	65.8776	23.5948	7.3539	1.0757	0.1210	0.0000	0.0000	0.0000	0.0000	1.6482	22.7305	76.8755	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												199.2773	
Space heating per m2										(98c) / (4) =		2.9967	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	65.8776	23.5948	7.3539	1.0757	0.1210	0.0000	0.0000	0.0000	0.0000	1.6482	22.7305	76.8755	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	65.8776	23.5948	7.3539	1.0757	0.1210	0.0000	0.0000	0.0000	0.0000	1.6482	22.7305	76.8755	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5760	10.4558	11.5760	11.2026	11.5760	11.2026	11.5760	11.5760	11.2026	11.5760	11.2026	11.5760	(231)
Lighting	19.0422	15.2763	13.7546	10.0772	7.7840	6.3596	7.1008	9.2299	11.9887	15.7298	17.7668	19.5714	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.8391	-25.0585	-40.6536	-51.2456	-60.2346	-57.9825	-57.0592	-51.4970	-42.0573	-30.6751	-18.2170	-13.3635	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.1159	-7.4362	-16.6099	-27.6777	-38.7100	-39.7745	-39.2119	-31.7414	-21.6778	-11.4238	-4.4458	-2.3728	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	199.2773	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2475.6013	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.2984	(230a)
Total electricity for the above, kWh/year	136.2984	(231)
Electricity for lighting (calculated in Appendix L)	153.6812	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-708.0805	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2256.7778	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	199.2773	16.4900	32.8608	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	16.4900	408.2267	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	136.2984	16.4900	22.4756	(249)
Energy for lighting	153.6812	16.4900	25.3420	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-463.8828	16.4900	-76.4943	
PV Unit electricity exported	-244.1976	5.5900	-13.6506	
Total			-90.1449	(252)
Total energy cost			398.7602	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2875	(257)
SAP value		79.1300	
SAP rating (Section 12)		79	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	199.2773	0.1606	31.9953	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2475.6013	0.1413	349.7834	(264)
Space and water heating			381.7788	(265)
Pumps, fans and electric keep-hot	136.2984	0.1387	18.9063	(267)
Energy for lighting	153.6812	0.1443	22.1809	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-463.8828	0.1323	-61.3812	
PV Unit electricity exported	-244.1976	0.1233	-30.1140	
Total			-91.4951	(269)
Total CO2, kg/year			331.3709	(272)
CO2 emissions per m2			4.9800	(273)
EI value			96.0176	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.5000	(1b)	x 2.4000	(2b) =	159.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		159.6000	(5)

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2. Ventilation rate

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m3 per hour

Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery		
If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			17.9500	1.2357	22.1816			(27)
External Wall 1	43.9000	17.9500	25.9500	0.1400	3.6330	14.0000	363.3000	(29a)
Total net area of external elements Aum(A, m2)			43.9000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.8146			(33)
Party Wall 1			55.9300	0.0000	0.0000	20.0000	1118.6000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.5000			80.0000	5320.0000	(32d)
Party Ceiling 1			66.5000			80.0000	5320.0000	(32b)
Internal Wall 1			140.2900			9.0000	1262.6100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13461.5100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.4287 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	7.7300	0.0500	0.3865
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	32.5200	0.0700	2.2764
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	44.2800	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.1469 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	29.9615 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.1032	16.1032	15.7675	14.7602	14.5923	13.9208	13.5851	13.5851	14.2566	15.0960	15.4317	15.2638	(38)
Heat transfer coeff	46.0647	46.0647	45.7289	44.7217	44.5538	43.8823	43.5465	43.5465	44.2180	45.0574	45.3932	45.2253	(39)
Average = Sum(39)m / 12 =												44.8336	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6927	0.6927	0.6877	0.6725	0.6700	0.6599	0.6548	0.6548	0.6649	0.6776	0.6826	0.6801	(40)
HLP (average)												0.6742	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1583	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
83.0588	81.8106	79.9917	76.5116	73.9433	71.0793	69.4513	71.2564	73.2352	76.3103	79.8652	82.7406	(42a)

Hot water usage for baths

26.1000	25.7123	25.1665	24.1600	23.4064	22.5708	22.1194	22.6614	23.2516	24.1458	25.1729	26.0117	(42b)

Hot water usage for other uses

36.7327	35.3969	34.0612	32.7255	31.3897	30.0540	30.0540	31.3897	32.7255	34.0612	35.3969	36.7327	(42c)

Average daily hot water use (litres/day)	134.1695	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.8914	142.9198	139.2194	133.3971	128.7395	123.7040	121.6247	125.3076	129.2122	134.5173	140.4351	145.4849	(44)
Energy conte	231.0563	203.5159	213.9750	182.6139	173.3081	152.1085	147.0945	155.1570	159.3316	182.5387	200.0755	227.7943	(45)

Energy content (annual)	Total = Sum(45)m =	2228.5693
Distribution loss (46)m = 0.15 x (45)m		

34.6584	30.5274	32.0962	27.3921	25.9962	22.8163	22.0642	23.2735	23.8997	27.3808	30.0113	34.1691	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
										Total per year (kWh/year) = Sum(64)m =		2475.6013	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	93.6109	82.8294	87.9313	76.9623	74.4096	66.8193	65.6936	68.3743	69.2210	77.4788	82.7683	92.5262	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.7552	19.3227	15.7143	11.8967	8.8930	7.5078	8.1125	10.5449	14.1533	17.9709	20.9747	22.3598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	282.0814	285.0085	277.6323	261.9291	242.1067	223.4764	211.0302	208.1031	215.4793	231.1825	251.0049	269.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	(71)
Water heating gains (Table 5)													
	125.8211	123.2580	118.1873	106.8921	100.0129	92.8046	88.2978	91.9010	96.1402	104.1381	114.9560	124.3632	(72)
Total internal gains													
	522.9304	520.8621	504.8066	473.9908	444.2853	417.0615	400.7133	403.8217	419.0457	446.5643	480.2084	509.6310	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	10.7700	33.4622	0.6300	0.8270	0.7700	130.1217	(77)
Southwest	7.1800	33.4622	0.6300	0.8270	0.7700	86.7478	(79)

Solar gains	216.8696	394.2722	563.7846	734.8050	814.7097	786.0956	767.2902	683.7861	604.9927	433.1436	266.9540	189.8007	(83)
Total gains	739.8000	915.1343	1068.5913	1208.7958	1258.9950	1203.1571	1168.0034	1087.6078	1024.0384	879.7078	747.1624	699.4317	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	81.1751	81.1751	81.7712	83.6129	83.9280	85.2123	85.8693	85.8693	84.5652	82.9898	82.3760	82.6818	
alpha	6.4117	6.4117	6.4514	6.5742	6.5952	6.6808	6.7246	6.7246	6.6377	6.5327	6.4917	6.5121	
util living area													
	0.8906	0.7798	0.6431	0.4825	0.3642	0.2844	0.2274	0.2482	0.3538	0.5718	0.8022	0.9102	(86)
MIT	20.7290	20.8829	20.9641	20.9945	20.9992	20.9999	21.0000	21.0000	20.9995	20.9871	20.8855	20.6924	(87)
Th 2	20.3473	20.3473	20.3518	20.3652	20.3674	20.3764	20.3809	20.3809	20.3719	20.3607	20.3562	20.3585	(88)
util rest of house													
	0.8752	0.7580	0.6189	0.4596	0.3419	0.2617	0.2043	0.2234	0.3268	0.5412	0.7778	0.8968	(89)
MIT 2	20.0498	20.2245	20.3160	20.3601	20.3668	20.3763	20.3809	20.3809	20.3715	20.3492	20.2391	20.0170	(90)
Living area fraction										fLA = Living area / (4) =		0.3370	(91)
MIT	20.2787	20.4464	20.5344	20.5739	20.5799	20.5865	20.5895	20.5895	20.5832	20.5642	20.4569	20.2446	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2787	20.4464	20.5344	20.5739	20.5799	20.5865	20.5895	20.5895	20.5832	20.5642	20.4569	20.2446	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8734	0.7614	0.6258	0.4672	0.3494	0.2694	0.2121	0.2318	0.3359	0.5510	0.7818	0.8942	(94)
Useful gains	646.1594	696.8174	668.7070	564.7212	439.9070	324.0974	247.7528	252.1023	343.9917	484.7375	584.1080	625.4624	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	754.4802	743.7771	682.9348	566.7990	440.1869	324.1345	247.7586	252.1127	344.1560	489.5121	629.0109	748.2347	(97)
Space heating kWh													
	80.5907	31.5569	10.5855	1.4960	0.2082	0.0000	0.0000	0.0000	0.0000	3.5523	32.3301	91.3425	(98a)
Space heating requirement - total per year (kWh/year)												251.6622	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	80.5907	31.5569	10.5855	1.4960	0.2082	0.0000	0.0000	0.0000	0.0000	3.5523	32.3301	91.3425	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												251.6622	
Space heating per m2											(98c) / (4) =	3.7844	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement												

	80.5907	31.5569	10.5855	1.4960	0.2082	0.0000	0.0000	0.0000	0.0000	3.5523	32.3301	91.3425 (98)
Space heating efficiency (main heating system 1)												
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)												
	80.5907	31.5569	10.5855	1.4960	0.2082	0.0000	0.0000	0.0000	0.0000	3.5523	32.3301	91.3425 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	11.5760	10.4558	11.5760	11.2026	11.5760	11.2026	11.5760	11.5760	11.2026	11.5760	11.2026	11.5760 (231)
Lighting	19.0422	15.2763	13.7546	10.0772	7.7840	6.3596	7.1008	9.2299	11.9887	15.7298	17.7668	19.5714 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-14.3667	-24.1477	-40.6887	-53.4206	-62.3575	-58.8247	-58.3796	-51.5126	-41.7801	-29.4067	-16.9631	-12.3641 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.6220	-6.9149	-16.5552	-29.8200	-41.2989	-40.8780	-40.9539	-31.7592	-21.4223	-10.5951	-3.9054	-2.0639 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	251.6622 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2475.6013 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	136.2984 (230a)
Total electricity for the above, kWh/year	136.2984 (231)
Electricity for lighting (calculated in Appendix L)	153.6812 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-713.0011 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2304.2421 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	251.6622	25.1600	63.3182	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	25.1600	622.8613	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	136.2984	25.1600	34.2927	(249)
Energy for lighting	153.6812	25.1600	38.6662	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.2121	25.1600	-116.7958	
PV Unit electricity exported	-248.7890	5.8100	-14.4546	
Total			-131.2504	(252)
Total energy cost			627.8880	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	251.6622	0.1601	40.3002	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2475.6013	0.1413	349.7834	(264)
Space and water heating			390.0836	(265)
Pumps, fans and electric keep-hot	136.2984	0.1387	18.9063	(267)
Energy for lighting	153.6812	0.1443	22.1809	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.2121	0.1320	-61.2829	
PV Unit electricity exported	-248.7890	0.1228	-30.5546	
Total			-91.8374	(269)
Total CO2, kg/year			339.3334	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	

Space heating - main system 1	251.6622	1.5926	400.7994	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	1.5225	3769.0221	(278)
Space and water heating			4169.8215	(279)
Pumps, fans and electric keep-hot	136.2984	1.5128	206.1922	(281)
Energy for lighting	153.6812	1.5338	235.7213	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.2121	1.4878	-690.6382	
PV Unit electricity exported	-248.7890	0.4507	-112.1351	
Total			-802.7733	(283)
Total Primary energy kWh/year			3808.9617	(286)

Predicted Energy Assessment

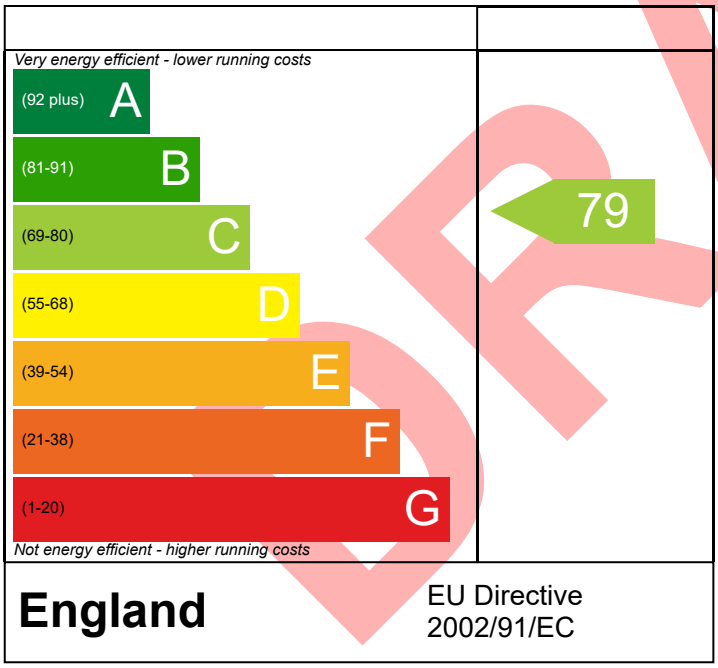
elmhurst energy

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	66.5 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

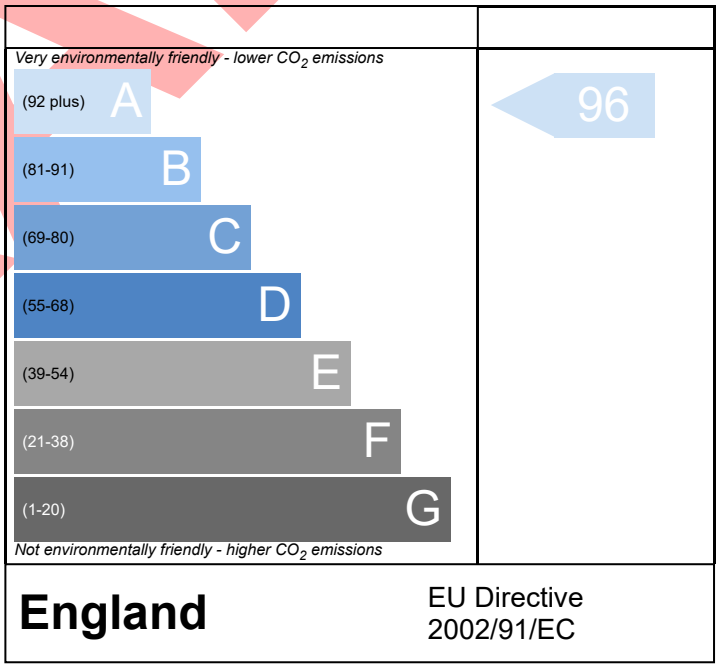
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:21

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	49 m^2
Site Reference	Unit 123 L06_Copy	Plot Reference	Unit 123 L06_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.84 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	5.64 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*64.47 kWh$_{PE}$/m^2*	
Dwelling primary energy	63.3 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*14.7 kWh/m^2*	
Dwelling fabric energy efficiency	14.0 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	7.88	0.14 **(!)**
Party wall: Party Wall (1)	24.84	0 **(!)**
Party wall: Party Wall (2)	39.01	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	6.29	North East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.63 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 123 L06_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 123 L06_Copy	**Prop Type Ref**	Unit 123 L06
Property			

SAP Rating	79 C	**DER**	5.64	**TER**	11.84
Environmental	96 A	**% DER < TER**			52.36
CO_2 Emissions (t/year)	0.27	**DFEE**	14.03	**TFEE**	14.73
Compliance Check	See BREL	**% DFEE < TFEE**			4.71
% DPER < TPER	1.82	**DPER**	63.30	**TPER**	64.47

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.8100 (1b)	x	2.4000 (2b)	=	117.1440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.8100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	117.1440	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.2900	1.2357	7.7728			(27)
External Wall 1	14.1700	6.2900	7.8800	0.1400	1.1032	14.0000	110.3200	(29a)
Total net area of external elements Aum(A, m2)			14.1700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		8.8760			(33)
Party Wall 1			24.8400	0.0000	0.0000	20.0000	496.8000	(32)
Wall to corridor			39.0100	0.0000	0.0000	20.0000	780.2000	(32)
Party Floor 1			48.8100			80.0000	3904.8000	(32d)
Party Ceiling 1			48.8100			80.0000	3904.8000	(32b)
Internal Wall 1			72.6800			9.0000	654.1200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 9851.0400	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	201.8242	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.7100	0.0500	0.1355

E4 Jamb	9.2800	0.0500	0.4640	
E7 Party floor between dwellings (in blocks of flats)	10.5000	0.0700	0.7350	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	41.6800	0.0000	0.0000	
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				1.6585 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	10.5345 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.1418	11.0295	10.9171	10.3554	10.2430	9.6813	9.6813	9.5689	9.9060	10.2430	10.4677	10.6924	(38)
Heat transfer coeff	21.6763	21.5640	21.4516	20.8899	20.7775	20.2158	20.2158	20.1035	20.4405	20.7775	21.0022	21.2269	(39)
Average = Sum(39)m / 12 =												20.8618	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4441	0.4418	0.4395	0.4280	0.4257	0.4142	0.4142	0.4119	0.4188	0.4257	0.4303	0.4349	(40)
HLP (average)												0.4274	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6551 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
71.4595	70.3856	68.8207	65.8266	63.6170	61.1529	59.7523	61.3053	63.0077	65.6534	68.7119	71.1857	(42a)

Hot water usage for baths

22.4723	22.1385	21.6685	20.8020	20.1531	19.4336	19.0450	19.5117	20.0198	20.7897	21.6741	22.3963	(42b)

Hot water usage for other uses

31.5802	30.4318	29.2834	28.1350	26.9867	25.8383	25.8383	26.9867	28.1350	29.2834	30.4318	31.5802	(42c)

Average daily hot water use (litres/day) 115.4278 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	125.5119	122.9558	119.7726	114.7636	110.7568	106.4248	104.6356	107.8037	111.1626	115.7265	120.8177	125.1621	(44)
Energy conte	198.7801	175.0875	184.0861	157.1056	149.0999	130.8617	126.5476	133.4834	137.0746	157.0398	172.1270	195.9736	(45)
Energy content (annual)											Total = Sum(45)m =	1917.2669	
Distribution loss (46)m = 0.15 x (45)m	29.8170	26.2631	27.6129	23.5658	22.3650	19.6293	18.9821	20.0225	20.5612	23.5560	25.8191	29.3960	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
										Total per year (kWh/year) = Sum(64)m =		2164.2989	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	82.8790	73.3769	77.9933	68.4808	66.3603	59.7547	58.8617	61.1679	61.8205	69.0004	73.4754	81.9459	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.4855	15.5304	12.6302	9.5619	7.1476	6.0343	6.5203	8.4753	11.3756	14.4439	16.8582	17.9715	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.1398	217.3723	211.7465	199.7699	184.6516	170.4425	160.9500	158.7175	164.3433	176.3199	191.4382	205.6473	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	(71)
Water heating gains (Table 5)	111.3965	109.1918	104.8296	95.1122	89.1940	82.9927	79.1152	82.2149	85.8618	92.7424	102.0492	110.1423	(72)
Total internal gains	423.7103	421.7830	408.8948	384.1325	360.6817	339.1579	326.2739	329.0962	341.2691	363.1946	390.0340	413.4494	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.2900	11.2829	0.6300	0.8270	0.7700	25.6243	(75)

Solar gains	25.6243	52.1590	93.9740	154.3323	207.4529	221.1667	206.8969	164.9406	114.5088	63.7425	32.2420	20.9261	(83)
Total gains	449.3346	473.9420	502.8688	538.4647	568.1345	560.3246	533.1709	494.0368	455.7778	426.9371	422.2760	434.3755	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	126.2390	126.8968	127.5613	130.9916	131.6998	135.3594	135.3594	136.1159	133.8715	131.6998	130.2908	128.9116	
alpha	9.4159	9.4598	9.5041	9.7328	9.7800	10.0240	10.0240	10.0744	9.9248	9.7800	9.6861	9.5941	
util living area	0.7828	0.7218	0.6161	0.4693	0.3401	0.2309	0.1668	0.1872	0.3094	0.5058	0.6852	0.7957	(86)
MIT	20.9686	20.9845	20.9962	20.9997	21.0000	21.0000	21.0000	21.0000	21.0000	20.9996	20.9921	20.9664	(87)
Th 2	20.5723	20.5745	20.5766	20.5873	20.5894	20.6001	20.6001	20.6023	20.5958	20.5894	20.5851	20.5809	(88)
util rest of house	0.7662	0.7046	0.5986	0.4533	0.3251	0.2165	0.1517	0.1710	0.2913	0.4859	0.6660	0.7796	(89)
MIT 2	20.5393	20.5585	20.5729	20.5870	20.5894	20.6001	20.6001	20.6023	20.5958	20.5891	20.5774	20.5453	(90)
Living area fraction										fLA = Living area / (4) =		0.5530	(91)
MIT	20.7767	20.7940	20.8070	20.8152	20.8164	20.8212	20.8212	20.8222	20.8193	20.8161	20.8067	20.7781	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7767	20.7940	20.8070	20.8152	20.8164	20.8212	20.8212	20.8222	20.8193	20.8161	20.8067	20.7781	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7742	0.7135	0.6081	0.4621	0.3334	0.2245	0.1601	0.1799	0.3013	0.4969	0.6763	0.7873	(94)
Useful gains	347.8709	338.1626	305.8060	248.8350	189.4146	125.7673	85.3357	88.9014	137.3457	212.1497	285.5935	341.9735	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	357.1540	342.7386	306.9076	248.9083	189.4174	125.7674	85.3357	88.9014	137.3463	212.2647	287.8717	351.9032	(97)
Space heating kWh	6.9066	3.0751	0.8196	0.0528	0.0020	0.0000	0.0000	0.0000	0.0000	0.0855	1.6403	7.3876	(98a)
Space heating requirement - total per year (kWh/year)												19.9696	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	6.9066	3.0751	0.8196	0.0528	0.0020	0.0000	0.0000	0.0000	0.0000	0.0855	1.6403	7.3876	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												19.9696	
Space heating per m2											(98c) / (4) =	0.4091	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 100.0000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	6.9066	3.0751	0.8196	0.0528	0.0020	0.0000	0.0000	0.0000	0.0000	0.0855	1.6403	7.3876	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	6.9066	3.0751	0.8196	0.0528	0.0020	0.0000	0.0000	0.0000	0.0000	0.0855	1.6403	7.3876	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.4966	7.6744	8.4966	8.2225	8.4966	8.2225	8.4966	8.4966	8.2225	8.4966	8.2225	8.4966	(231)
Lighting	15.3049	12.2782	11.0551	8.0995	6.2563	5.1114	5.7072	7.4184	9.6358	12.6427	14.2798	15.7303	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.6150	-18.5334	-30.3073	-38.4599	-45.4028	-43.7828	-43.0940	-38.8073	-31.5720	-22.8792	-13.4517	-9.7828	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.2706	-5.2708	-11.6415	-19.3561	-27.0798	-27.8299	-27.4302	-22.1697	-15.1176	-7.9607	-3.1501	-1.7449	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year
Space heating fuel - main system 1 19.9696 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 100.0000
Water heating fuel used 2164.2989 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)
mechanical ventilation fans (SFP = 0.7000) 100.0410 (230a)
Total electricity for the above, kWh/year 100.0410 (231)
Electricity for lighting (calculated in Appendix L) 123.5196 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation -518.7101 (233)
Wind generation 0.0000 (234)
Hydro-electric generation (Appendix N) 0.0000 (235a)
Electricity generated - Micro CHP (Appendix N) 0.0000 (235)

Appendix Q - special features

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1889.1189	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	19.9696	16.4900	3.2930	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	16.4900	356.8929	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	100.0410	16.4900	16.4968	(249)
Energy for lighting	123.5196	16.4900	20.3684	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.6881	16.4900	-57.3338	
PV Unit electricity exported	-171.0220	5.5900	-9.5601	
Total			-66.8939	(252)
Total energy cost			330.1571	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2670	(257)
SAP value		79.4621	
SAP rating (Section 12)		79	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	19.9696	0.1610	3.2145	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2164.2989	0.1413	305.7097	(264)
Space and water heating			308.9242	(265)
Pumps, fans and electric keep-hot	100.0410	0.1387	13.8769	(267)
Energy for lighting	123.5196	0.1443	17.8277	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.6881	0.1322	-45.9615	
PV Unit electricity exported	-171.0220	0.1234	-21.1115	
Total			-67.0730	(269)
Total CO2, kg/year			273.5559	(272)
CO2 emissions per m2			5.6000	(273)
EI value			96.0925	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.8100	(1b)	x 2.4000	(2b) =	117.1440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 48.8100						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		117.1440	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.2900	1.2357	7.7728			(27)
External Wall 1	14.1700	6.2900	7.8800	0.1400	1.1032	14.0000	110.3200	(29a)
Total net area of external elements Aum(A, m2)			14.1700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		8.8760			(33)
Party Wall 1			24.8400	0.0000	0.0000	20.0000	496.8000	(32)
Wall to corridor			39.0100	0.0000	0.0000	20.0000	780.2000	(32)
Party Floor 1			48.8100			80.0000	3904.8000	(32d)
Party Ceiling 1			48.8100			80.0000	3904.8000	(32b)
Internal Wall 1			72.6800			9.0000	654.1200	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9851.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 201.8242 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.7100	0.0500	0.1355
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	10.5000	0.0700	0.7350
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	41.6800	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.6585 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 10.5345 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.2542	11.2542	11.0295	10.3554	10.2430	9.7936	9.5689	9.5689	10.0183	10.5801	10.8048	10.6924	(38)
Heat transfer coeff	21.7887	21.7887	21.5640	20.8899	20.7775	20.3282	20.1035	20.1035	20.5529	21.1146	21.3393	21.2269	(39)

Average = Sum(39)m / 12 = 20.9648

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4464	0.4464	0.4418	0.4280	0.4257	0.4165	0.4119	0.4119	0.4211	0.4326	0.4372	0.4349	(40)
HLP (average)												0.4295	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6551 (42)
Hot water usage for mixer showers

71.4595	70.3856	68.8207	65.8266	63.6170	61.1529	59.7523	61.3053	63.0077	65.6534	68.7119	71.1857	(42a)

Hot water usage for baths

22.4723	22.1385	21.6685	20.8020	20.1531	19.4336	19.0450	19.5117	20.0198	20.7897	21.6741	22.3963	(42b)

Hot water usage for other uses

31.5802	30.4318	29.2834	28.1350	26.9867	25.8383	25.8383	26.9867	28.1350	29.2834	30.4318	31.5802	(42c)

Average daily hot water use (litres/day) 115.4278 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	125.5119	122.9558	119.7726	114.7636	110.7568	106.4248	104.6356	107.8037	111.1626	115.7265	120.8177	125.1621	(44)
Energy conte	198.7801	175.0875	184.0861	157.1056	149.0999	130.8617	126.5476	133.4834	137.0746	157.0398	172.1270	195.9736	(45)

Energy content (annual) Total = Sum(45)m = 1917.2669

Distribution loss (46)m = 0.15 x (45)m												
29.8170	26.2631	27.6129	23.5658	22.3650	19.6293	18.9821	20.0225	20.5612	23.5560	25.8191	29.3960	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h												
219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)

Total per year (kWh/year) = Sum(64)m = 2164.2989 (64)

Electric shower(s)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month												
82.8790	73.3769	77.9933	68.4808	66.3603	59.7547	58.8617	61.1679	61.8205	69.0004	73.4754	81.9459	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	17.4855	15.5304	12.6302	9.5619	7.1476	6.0343	6.5203	8.4753	11.3756	14.4439	16.8582	17.9715	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	215.1398	217.3723	211.7465	199.7699	184.6516	170.4425	160.9500	158.7175	164.3433	176.3199	191.4382	205.6473	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	(71)

Water heating gains (Table 5)

	111.3965	109.1918	104.8296	95.1122	89.1940	82.9927	79.1152	82.2149	85.8618	92.7424	102.0492	110.1423	(72)

Total internal gains

	423.7103	421.7830	408.8948	384.1325	360.6817	339.1579	326.2739	329.0962	341.2691	363.1946	390.0340	413.4494	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.2900	10.0309	0.6300	0.8270	0.7700	22.7809	(75)

Solar gains	22.7809	49.3199	92.7016	160.6228	214.7931	223.1785	211.1088	162.9125	112.0170	59.8425	29.4243	19.0490	(83)
Total gains	446.4911	471.1029	501.5964	544.7552	575.4748	562.3364	537.3828	492.0087	453.2861	423.0371	419.4582	432.4984	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	125.5881	125.5881	126.8968	130.9916	131.6998	134.6113	136.1159	136.1159	133.1397	129.5976	128.2329	128.9116	
alpha	9.3725	9.3725	9.4598	9.7328	9.7800	9.9741	10.0744	10.0744	9.8760	9.6398	9.5489	9.5941	
util living area	0.8046	0.7556	0.6575	0.5020	0.3719	0.2820	0.2282	0.2533	0.3718	0.5630	0.7222	0.8167	(86)
MIT	20.9592	20.9759	20.9930	20.9995	21.0000	21.0000	21.0000	21.0000	21.0000	20.9987	20.9866	20.9571	(87)
Th 2	20.5702	20.5702	20.5745	20.5873	20.5894	20.5980	20.6023	20.6023	20.5937	20.5830	20.5787	20.5809	(88)
util rest of house	0.7887	0.7388	0.6402	0.4863	0.3570	0.2674	0.2133	0.2371	0.3534	0.5425	0.7030	0.8015	(89)
MIT 2	20.5268	20.5450	20.5674	20.5868	20.5894	20.5980	20.6023	20.6023	20.5937	20.5819	20.5653	20.5349	(90)
Living area fraction									fLA = Living area / (4) =			0.5530	(91)
MIT	20.7659	20.7832	20.8027	20.8150	20.8164	20.8203	20.8222	20.8222	20.8183	20.8124	20.7983	20.7684	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7659	20.7832	20.8027	20.8150	20.8164	20.8203	20.8222	20.8222	20.8183	20.8124	20.7983	20.7684	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7960	0.7472	0.6495	0.4950	0.3652	0.2755	0.2215	0.2461	0.3636	0.5538	0.7130	0.8084	(94)
Useful gains	355.4009	352.0105	325.7750	269.6470	210.1876	154.9059	119.0566	121.0669	164.7952	234.2765	299.0886	349.6108	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	367.4858	359.1483	327.8314	269.7930	210.1946	154.9062	119.0566	121.0670	164.8000	234.6331	302.9812	362.3092	(97)
Space heating kWh	8.9911	4.7966	1.5300	0.1051	0.0052	0.0000	0.0000	0.0000	0.0000	0.2653	2.8027	9.4476	(98a)
Space heating requirement - total per year (kWh/year)												27.9437	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	8.9911	4.7966	1.5300	0.1051	0.0052	0.0000	0.0000	0.0000	0.0000	0.2653	2.8027	9.4476	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												27.9437	
Space heating per m2										(98c) / (4) =		0.5725	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	8.9911	4.7966	1.5300	0.1051	0.0052	0.0000	0.0000	0.0000	0.0000	0.2653	2.8027	9.4476	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	8.9911	4.7966	1.5300	0.1051	0.0052	0.0000	0.0000	0.0000	0.0000	0.2653	2.8027	9.4476	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating

Water heating requirement

	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(219)

Space cooling fuel requirement

(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.4966	7.6744	8.4966	8.2225	8.4966	8.2225	8.4966	8.4966	8.2225	8.4966	8.2225	8.4966	(231)
Lighting	15.3049	12.2782	11.0551	8.0995	6.2563	5.1114	5.7072	7.4184	9.6358	12.6427	14.2798	15.7303	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.5162	-17.8280	-30.3076	-40.1113	-47.0328	-44.4324	-44.1129	-38.8193	-31.3606	-21.9091	-12.4988	-9.0372	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.9290	-4.9272	-11.6268	-20.8672	-28.9016	-28.6057	-28.6546	-22.1822	-14.9388	-7.3945	-2.7886	-1.5322	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	27.9437	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2164.2989	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	100.0410	(230a)
Total electricity for the above, kWh/year	100.0410	(231)
Electricity for lighting (calculated in Appendix L)	123.5196	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-522.3147	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1893.4884	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	27.9437	25.1600	7.0306	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	25.1600	544.5376	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	100.0410	25.1600	25.1703	(249)
Energy for lighting	123.5196	25.1600	31.0775	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.9662	25.1600	-87.5483	
PV Unit electricity exported	-174.3485	5.8100	-10.1296	
Total			-97.6780	(252)
Total energy cost			510.1381	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	27.9437	0.1604	4.4821	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2164.2989	0.1413	305.7097	(264)
Space and water heating			310.1918	(265)
Pumps, fans and electric keep-hot	100.0410	0.1387	13.8769	(267)
Energy for lighting	123.5196	0.1443	17.8277	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.9662	0.1319	-45.8901	
PV Unit electricity exported	-174.3485	0.1230	-21.4381	
Total			-67.3283	(269)
Total CO2, kg/year			274.5681	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	27.9437	1.5936	44.5320	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	1.5223	3294.7406	(278)
Space and water heating			3339.2725	(279)
Pumps, fans and electric keep-hot	100.0410	1.5128	151.3420	(281)
Energy for lighting	123.5196	1.5338	189.4585	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.9662	1.4873	-517.5169	
PV Unit electricity exported	-174.3485	0.4513	-78.6774	
Total			-596.1943	(283)
Total Primary energy kWh/year			3083.8787	(286)

SAP 10 EPC IMPROVEMENTS

Unit 123 L06_Copy

Current energy efficiency rating: C 79
Current environmental impact rating: A 96

N Solar water heating — Not applicable
U Solar photovoltaic panels — Not applicable
V2 Wind turbine — Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 79
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£608	£608	£0
Space heating	£32	£32	£0
Water heating	£545	£545	£0
Lighting	£31	£31	£0
Generated (PV)	-£98	-£98	£0
Total cost of fuels	£510	£510	£0
Total cost of uses	£510	£510	£0
Delivered energy	39 kWh/m²	39 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	63 kWh/m²	63 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.8100 (1b)	x	2.4000 (2b)	=	117.1440	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.8100					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	117.1440	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation — 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) — 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = — 72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.2900	1.2357	7.7728			(27)
External Wall 1	14.1700	6.2900	7.8800	0.1400	1.1032	14.0000	110.3200	(29a)
Total net area of external elements Aum(A, m2)			14.1700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		8.8760			(33)
Party Wall 1			24.8400	0.0000	0.0000	20.0000	496.8000	(32)
Wall to corridor			39.0100	0.0000	0.0000	20.0000	780.2000	(32)
Party Floor 1			48.8100			80.0000	3904.8000	(32d)
Party Ceiling 1			48.8100			80.0000	3904.8000	(32b)
Internal Wall 1			72.6800			9.0000	654.1200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9851.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		201.8242 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.7100	0.0500	0.1355
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	10.5000	0.0700	0.7350
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	41.6800	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.6585 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	10.5345 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.1418	11.0295	10.9171	10.3554	10.2430	9.6813	9.6813	9.5689	9.9060	10.2430	10.4677	10.6924	(38)
Heat transfer coeff	21.6763	21.5640	21.4516	20.8899	20.7775	20.2158	20.2158	20.1035	20.4405	20.7775	21.0022	21.2269	(39)
Average = Sum(39)m / 12 =												20.8618	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4441	0.4418	0.4395	0.4280	0.4257	0.4142	0.4142	0.4119	0.4188	0.4257	0.4303	0.4349	(40)
HLP (average)												0.4274	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.6551 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	71.4595	70.3856	68.8207	65.8266	63.6170	61.1529	59.7523	61.3053	63.0077	65.6534	68.7119	71.1857	(42a)
Hot water usage for baths	22.4723	22.1385	21.6685	20.8020	20.1531	19.4336	19.0450	19.5117	20.0198	20.7897	21.6741	22.3963	(42b)
Hot water usage for other uses	31.5802	30.4318	29.2834	28.1350	26.9867	25.8383	25.8383	26.9867	28.1350	29.2834	30.4318	31.5802	(42c)
Average daily hot water use (litres/day)												115.4278	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	125.5119	122.9558	119.7726	114.7636	110.7568	106.4248	104.6356	107.8037	111.1626	115.7265	120.8177	125.1621	(44)
Energy conte	198.7801	175.0875	184.0861	157.1056	149.0999	130.8617	126.5476	133.4834	137.0746	157.0398	172.1270	195.9736	(45)
Energy content (annual)										Total = Sum(45)m =		1917.2669	
Distribution loss (46)m = 0.15 x (45)m	29.8170	26.2631	27.6129	23.5658	22.3650	19.6293	18.9821	20.0225	20.5612	23.5560	25.8191	29.3960	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
										Total per year (kWh/year) = Sum(64)m =		2164.2989	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	82.8790	73.3769	77.9933	68.4808	66.3603	59.7547	58.8617	61.1679	61.8205	69.0004	73.4754	81.9459	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.4855	15.5304	12.6302	9.5619	7.1476	6.0343	6.5203	8.4753	11.3756	14.4439	16.8582	17.9715	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.1398	217.3723	211.7465	199.7699	184.6516	170.4425	160.9500	158.7175	164.3433	176.3199	191.4382	205.6473	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	(71)
Water heating gains (Table 5)	111.3965	109.1918	104.8296	95.1122	89.1940	82.9927	79.1152	82.2149	85.8618	92.7424	102.0492	110.1423	(72)
Total internal gains	423.7103	421.7830	408.8948	384.1325	360.6817	339.1579	326.2739	329.0962	341.2691	363.1946	390.0340	413.4494	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.2900	11.2829	0.6300	0.8270	0.7700	25.6243	(75)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	25.6243	52.1590	93.9740	154.3323	207.4529	221.1667	206.8969	164.9406	114.5088	63.7425	32.2420	20.9261	(83)
Total gains	449.3346	473.9420	502.8688	538.4647	568.1345	560.3246	533.1709	494.0368	455.7778	426.9371	422.2760	434.3755	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	126.2390	126.8968	127.5613	130.9916	131.6998	135.3594	135.3594	136.1159	133.8715	131.6998	130.2908	128.9116	
alpha	9.4159	9.4598	9.5041	9.7328	9.7800	10.0240	10.0240	10.0744	9.9248	9.7800	9.6861	9.5941	
util living area	0.7828	0.7218	0.6161	0.4693	0.3401	0.2309	0.1668	0.1872	0.3094	0.5058	0.6852	0.7957	(86)
MIT	20.9686	20.9845	20.9962	20.9997	21.0000	21.0000	21.0000	21.0000	21.0000	20.9996	20.9921	20.9664	(87)
Th 2	20.5723	20.5745	20.5766	20.5873	20.5894	20.6001	20.6001	20.6023	20.5958	20.5894	20.5851	20.5809	(88)
util rest of house	0.7662	0.7046	0.5986	0.4533	0.3251	0.2165	0.1517	0.1710	0.2913	0.4859	0.6660	0.7796	(89)
MIT 2	20.5393	20.5585	20.5729	20.5870	20.5894	20.6001	20.6001	20.6023	20.5958	20.5891	20.5774	20.5453	(90)
Living area fraction										fLA = Living area / (4) =		0.5530	(91)
MIT	20.7767	20.7940	20.8070	20.8152	20.8164	20.8212	20.8212	20.8222	20.8193	20.8161	20.8067	20.7781	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7767	20.7940	20.8070	20.8152	20.8164	20.8212	20.8212	20.8222	20.8193	20.8161	20.8067	20.7781	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7742	0.7135	0.6081	0.4621	0.3334	0.2245	0.1601	0.1799	0.3013	0.4969	0.6763	0.7873	(94)
Useful gains	347.8709	338.1626	305.8060	248.8350	189.4146	125.7673	85.3357	88.9014	137.3457	212.1497	285.5935	341.9735	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	357.1540	342.7386	306.9076	248.9083	189.4174	125.7674	85.3357	88.9014	137.3463	212.2647	287.8717	351.9032	(97)
Space heating kWh	6.9066	3.0751	0.8196	0.0528	0.0020	0.0000	0.0000	0.0000	0.0000	0.0855	1.6403	7.3876	(98a)
Space heating requirement - total per year (kWh/year)												19.9696	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	6.9066	3.0751	0.8196	0.0528	0.0020	0.0000	0.0000	0.0000	0.0000	0.0855	1.6403	7.3876	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												19.9696	
Space heating per m2										(98c) / (4) =		0.4091	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	6.9066	3.0751	0.8196	0.0528	0.0020	0.0000	0.0000	0.0000	0.0000	0.0855	1.6403	7.3876	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	6.9066	3.0751	0.8196	0.0528	0.0020	0.0000	0.0000	0.0000	0.0000	0.0855	1.6403	7.3876	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.4966	7.6744	8.4966	8.2225	8.4966	8.2225	8.4966	8.4966	8.2225	8.4966	8.2225	8.4966	(231)
Lighting	15.3049	12.2782	11.0551	8.0995	6.2563	5.1114	5.7072	7.4184	9.6358	12.6427	14.2798	15.7303	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.6150	-18.5334	-30.3073	-38.4599	-45.4028	-43.7828	-43.0940	-38.8073	-31.5720	-22.8792	-13.4517	-9.7828	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.2706	-5.2708	-11.6415	-19.3561	-27.0798	-27.8299	-27.4302	-22.1697	-15.1176	-7.9607	-3.1501	-1.7449	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	19.9696	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2164.2989	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	100.0410	(230a)
Total electricity for the above, kWh/year	100.0410	(231)
Electricity for lighting (calculated in Appendix L)	123.5196	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-518.7101	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1889.1189	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	19.9696	16.4900	3.2930	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	16.4900	356.8929	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	100.0410	16.4900	16.4968	(249)
Energy for lighting	123.5196	16.4900	20.3684	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.6881	16.4900	-57.3338	
PV Unit electricity exported	-171.0220	5.5900	-9.5601	
Total			-66.8939	(252)
Total energy cost			330.1571	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2670	(257)
SAP value	79.4621	
SAP rating (Section 12)	79	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	19.9696	0.1610	3.2145	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2164.2989	0.1413	305.7097	(264)
Space and water heating			308.9242	(265)
Pumps, fans and electric keep-hot	100.0410	0.1387	13.8769	(267)
Energy for lighting	123.5196	0.1443	17.8277	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.6881	0.1322	-45.9615	
PV Unit electricity exported	-171.0220	0.1234	-21.1115	
Total			-67.0730	(269)
Total CO2, kg/year			273.5559	(272)
CO2 emissions per m2			5.6000	(273)
EI value			96.0925	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.8100	(1b)	x 2.4000	(2b) =	117.1440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.8100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		117.1440	(5)

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2. Ventilation rate

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m3 per hour

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery		
If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.2900	1.2357	7.7728			(27)
External Wall 1	14.1700	6.2900	7.8800	0.1400	1.1032	14.0000	110.3200	(29a)
Total net area of external elements Aum(A, m2)			14.1700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		8.8760			(33)
Party Wall 1			24.8400	0.0000	0.0000	20.0000	496.8000	(32)
Wall to corridor			39.0100	0.0000	0.0000	20.0000	780.2000	(32)
Party Floor 1			48.8100			80.0000	3904.8000	(32d)
Party Ceiling 1			48.8100			80.0000	3904.8000	(32b)
Internal Wall 1			72.6800			9.0000	654.1200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9851.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		201.8242 (35)
List of Thermal Bridges		

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.7100	0.0500	0.1355
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	10.5000	0.0700	0.7350
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	41.6800	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.6585 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	10.5345 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.2542	11.2542	11.0295	10.3554	10.2430	9.7936	9.5689	9.5689	10.0183	10.5801	10.8048	10.6924	(38)
Heat transfer coeff	21.7887	21.7887	21.5640	20.8899	20.7775	20.3282	20.1035	20.1035	20.5529	21.1146	21.3393	21.2269	(39)
Average = Sum(39)m / 12 =												20.9648	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4464	0.4464	0.4418	0.4280	0.4257	0.4165	0.4119	0.4119	0.4211	0.4326	0.4372	0.4349	(40)
HLP (average)												0.4295	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.6551 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
71.4595	70.3856	68.8207	65.8266	63.6170	61.1529	59.7523	61.3053	63.0077	65.6534	68.7119	71.1857	(42a)

Hot water usage for baths

22.4723	22.1385	21.6685	20.8020	20.1531	19.4336	19.0450	19.5117	20.0198	20.7897	21.6741	22.3963	(42b)

Hot water usage for other uses

31.5802	30.4318	29.2834	28.1350	26.9867	25.8383	25.8383	26.9867	28.1350	29.2834	30.4318	31.5802	(42c)

Average daily hot water use (litres/day)		115.4278 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	125.5119	122.9558	119.7726	114.7636	110.7568	106.4248	104.6356	107.8037	111.1626	115.7265	120.8177	125.1621	(44)
Energy conte	198.7801	175.0875	184.0861	157.1056	149.0999	130.8617	126.5476	133.4834	137.0746	157.0398	172.1270	195.9736	(45)
Energy content (annual)										Total = Sum(45)m =		1917.2669	
Distribution loss (46)m = 0.15 x (45)m													
	29.8170	26.2631	27.6129	23.5658	22.3650	19.6293	18.9821	20.0225	20.5612	23.5560	25.8191	29.3960	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544 (64)
										Total per year (kWh/year) = Sum(64)m =		2164.2989 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						0.0000 (64a)
Heat gains from water heating, kWh/month												
	82.8790	73.3769	77.9933	68.4808	66.3603	59.7547	58.8617	61.1679	61.8205	69.0004	73.4754	81.9459 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	17.4855	15.5304	12.6302	9.5619	7.1476	6.0343	6.5203	8.4753	11.3756	14.4439	16.8582	17.9715	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	215.1398	217.3723	211.7465	199.7699	184.6516	170.4425	160.9500	158.7175	164.3433	176.3199	191.4382	205.6473	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	(71)
Water heating gains (Table 5)													
	111.3965	109.1918	104.8296	95.1122	89.1940	82.9927	79.1152	82.2149	85.8618	92.7424	102.0492	110.1423	(72)
Total internal gains													
	423.7103	421.7830	408.8948	384.1325	360.6817	339.1579	326.2739	329.0962	341.2691	363.1946	390.0340	413.4494	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.2900	10.0309	0.6300	0.8270	0.7700	22.7809	(75)

Solar gains	22.7809	49.3199	92.7016	160.6228	214.7931	223.1785	211.1088	162.9125	112.0170	59.8425	29.4243	19.0490	(83)
Total gains	446.4911	471.1029	501.5964	544.7552	575.4748	562.3364	537.3828	492.0087	453.2861	423.0371	419.4582	432.4984	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	125.5881	125.5881	126.8968	130.9916	131.6998	134.6113	136.1159	136.1159	133.1397	129.5976	128.2329	128.9116	
alpha	9.3725	9.3725	9.4598	9.7328	9.7800	9.9741	10.0744	10.0744	9.8760	9.6398	9.5489	9.5941	
util living area													
	0.8046	0.7556	0.6575	0.5020	0.3719	0.2820	0.2282	0.2533	0.3718	0.5630	0.7222	0.8167	(86)
MIT	20.9592	20.9759	20.9930	20.9995	21.0000	21.0000	21.0000	21.0000	21.0000	20.9987	20.9866	20.9571	(87)
Th 2	20.5702	20.5702	20.5745	20.5873	20.5894	20.5980	20.6023	20.6023	20.5937	20.5830	20.5787	20.5809	(88)
util rest of house													
	0.7887	0.7388	0.6402	0.4863	0.3570	0.2674	0.2133	0.2371	0.3534	0.5425	0.7030	0.8015	(89)
MIT 2	20.5268	20.5450	20.5674	20.5868	20.5894	20.5980	20.6023	20.6023	20.5937	20.5819	20.5653	20.5349	(90)
Living area fraction										fLA = Living area / (4) =		0.5530	(91)
MIT	20.7659	20.7832	20.8027	20.8150	20.8164	20.8203	20.8222	20.8222	20.8183	20.8124	20.7983	20.7684	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7659	20.7832	20.8027	20.8150	20.8164	20.8203	20.8222	20.8222	20.8183	20.8124	20.7983	20.7684	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7960	0.7472	0.6495	0.4950	0.3652	0.2755	0.2215	0.2461	0.3636	0.5538	0.7130	0.8084	(94)
Useful gains	355.4009	352.0105	325.7750	269.6470	210.1876	154.9059	119.0566	121.0669	164.7952	234.2765	299.0886	349.6108	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	367.4858	359.1483	327.8314	269.7930	210.1946	154.9062	119.0566	121.0670	164.8000	234.6331	302.9812	362.3092	(97)
Space heating kWh													
	8.9911	4.7966	1.5300	0.1051	0.0052	0.0000	0.0000	0.0000	0.0000	0.2653	2.8027	9.4476	(98a)
Space heating requirement - total per year (kWh/year)												27.9437	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	8.9911	4.7966	1.5300	0.1051	0.0052	0.0000	0.0000	0.0000	0.0000	0.2653	2.8027	9.4476	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												27.9437	
Space heating per m2											(98c) / (4) =	0.5725	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement												

	8.9911	4.7966	1.5300	0.1051	0.0052	0.0000	0.0000	0.0000	0.0000	0.2653	2.8027	9.4476 (98)
Space heating efficiency (main heating system 1)												
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)												
	8.9911	4.7966	1.5300	0.1051	0.0052	0.0000	0.0000	0.0000	0.0000	0.2653	2.8027	9.4476 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	8.4966	7.6744	8.4966	8.2225	8.4966	8.2225	8.4966	8.4966	8.2225	8.4966	8.2225	8.4966 (231)
Lighting	15.3049	12.2782	11.0551	8.0995	6.2563	5.1114	5.7072	7.4184	9.6358	12.6427	14.2798	15.7303 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-10.5162	-17.8280	-30.3076	-40.1113	-47.0328	-44.4324	-44.1129	-38.8193	-31.3606	-21.9091	-12.4988	-9.0372 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-1.9290	-4.9272	-11.6268	-20.8672	-28.9016	-28.6057	-28.6546	-22.1822	-14.9388	-7.3945	-2.7886	-1.5322 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	27.9437 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2164.2989 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	100.0410 (230a)
Total electricity for the above, kWh/year	100.0410 (231)
Electricity for lighting (calculated in Appendix L)	123.5196 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-522.3147 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1893.4884 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	27.9437	25.1600	7.0306	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	25.1600	544.5376	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	100.0410	25.1600	25.1703	(249)
Energy for lighting	123.5196	25.1600	31.0775	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.9662	25.1600	-87.5483	
PV Unit electricity exported	-174.3485	5.8100	-10.1296	
Total			-97.6780	(252)
Total energy cost			510.1381	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	27.9437	0.1604	4.4821	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2164.2989	0.1413	305.7097	(264)
Space and water heating			310.1918	(265)
Pumps, fans and electric keep-hot	100.0410	0.1387	13.8769	(267)
Energy for lighting	123.5196	0.1443	17.8277	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.9662	0.1319	-45.8901	
PV Unit electricity exported	-174.3485	0.1230	-21.4381	
Total			-67.3283	(269)
Total CO2, kg/year			274.5681	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year

Space heating - main system 1	27.9437	1.5936	44.5320	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	1.5223	3294.7406	(278)
Space and water heating			3339.2725	(279)
Pumps, fans and electric keep-hot	100.0410	1.5128	151.3420	(281)
Energy for lighting	123.5196	1.5338	189.4585	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.9662	1.4873	-517.5169	
PV Unit electricity exported	-174.3485	0.4513	-78.6774	
Total			-596.1943	(283)
Total Primary energy kWh/year			3083.8787	(286)

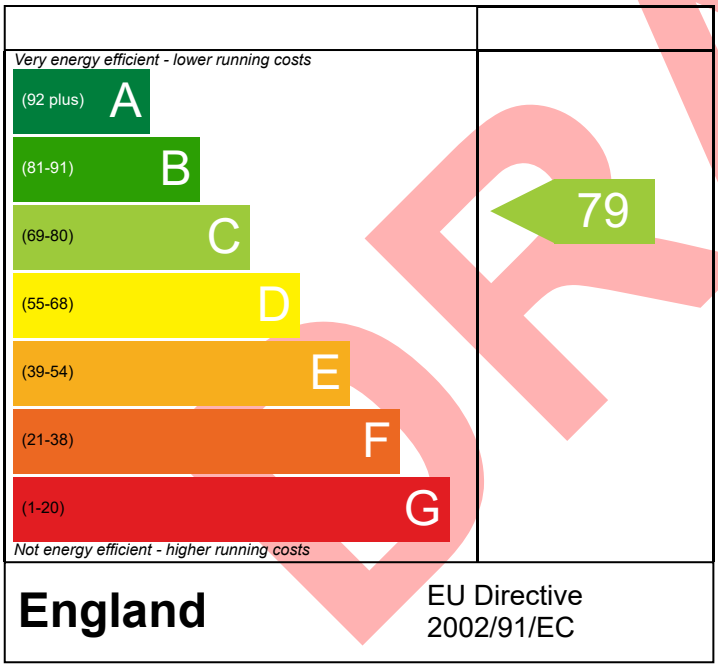
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	48.81 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

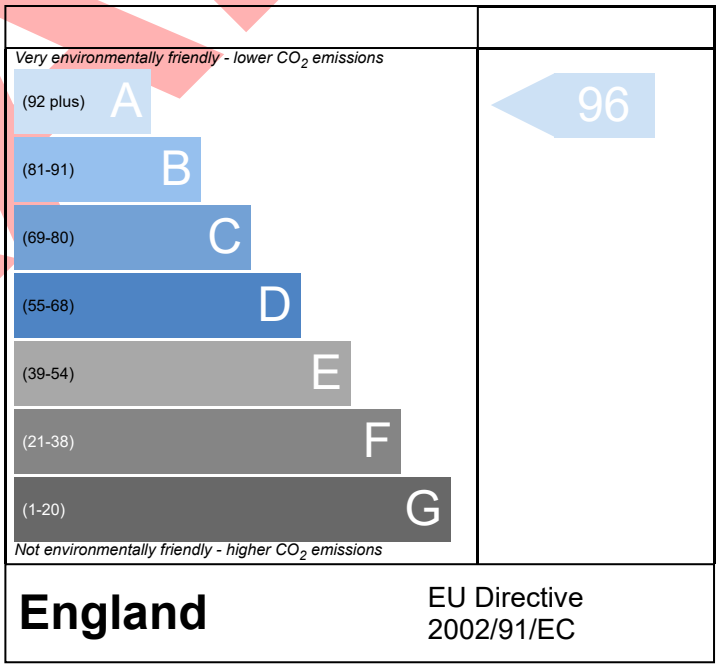
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:21

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	51 m^2
Site Reference	Unit 124 L06_Copy	Plot Reference	Unit 124 L06_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.19 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	5.39 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*60.85 kWh_{PE}/m^2*	
Dwelling primary energy	60.74 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*13.0 kWh/m^2*	
Dwelling fabric energy efficiency	11.9 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	8.61	0.14 **(!)**
Party wall: Party Wall (1)	47.52	0 **(!)**
Party wall: Party Wall (2)	15.8	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SE, Opening Type 1	7.18	South East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.67 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 124 L06_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 124 L06_Copy	**Prop Type Ref**	Unit 124 L06
Property			

SAP Rating	80 C	**DER**	5.39	**TER**	11.19
Environmental	96 A	**% DER < TER**			51.83
CO_2 Emissions (t/year)	0.28	**DFEE**	11.94	**TFEE**	13.00
Compliance Check	See BREL	**% DFEE < TFEE**			8.15
% DPER < TPER	0.18	**DPER**	60.74	**TPER**	60.85

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.4800 (1b)	x	2.4000 (2b)	=	123.5520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.4800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	123.5520	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.1800	1.2357	8.8726			(27)
External Wall 1	15.7900	7.1800	8.6100	0.1400	1.2054	14.0000	120.5400	(29a)
Total net area of external elements Aum(A, m2)			15.7900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.0780			(33)
Party Wall 1			47.5200	0.0000	0.0000	20.0000	950.4000	(32)
Wall to corridor			15.8000	0.0000	0.0000	20.0000	316.0000	(32)
Party Floor 1			51.4800			80.0000	4118.4000	(32d)
Party Ceiling 1			51.4800			80.0000	4118.4000	(32b)
Internal Wall 1			80.1900			9.0000	721.7100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 10345.4500	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	200.9606	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.0900	0.0500	0.1545

E4 Jamb	18.5600	0.0500	0.9280	
E7 Party floor between dwellings (in blocks of flats)	11.7000	0.0700	0.8190	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	46.9000	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.2255 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 12.3035 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.7513	11.6328	11.5143	10.9218	10.8033	10.2109	10.2109	10.0924	10.4479	10.8033	11.0403	11.2773	(38)
Heat transfer coeff	24.0548	23.9363	23.8178	23.2254	23.1069	22.5144	22.5144	22.3959	22.7514	23.1069	23.3439	23.5808	(39)
Average = Sum(39)m / 12 =												23.1957	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4673	0.4650	0.4627	0.4512	0.4489	0.4373	0.4373	0.4350	0.4419	0.4489	0.4535	0.4581	(40)
HLP (average)												0.4506	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7337 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.2716	72.1705	70.5659	67.4959	65.2303	62.7037	61.2676	62.8600	64.6056	67.3184	70.4543	72.9909	(42a)
Hot water usage for baths	23.0390	22.6968	22.2150	21.3266	20.6614	19.9237	19.5253	20.0037	20.5247	21.3140	22.2207	22.9611	(42b)
Hot water usage for other uses	32.3851	31.2075	30.0298	28.8522	27.6746	26.4969	26.4969	27.6746	28.8522	30.0298	31.2075	32.3851	(42c)
Average daily hot water use (litres/day)												118.3558	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.6957	126.0748	122.8108	117.6747	113.5662	109.1243	107.2898	110.5383	113.9825	118.6622	123.8825	128.3371	(44)
Energy conte	203.8226	179.5288	188.7556	161.0907	152.8819	134.1811	129.7577	136.8695	140.5518	161.0235	176.4934	200.9449	(45)
Energy content (annual)										Total = Sum(45)m =		1965.9015	
Distribution loss (46)m = 0.15 x (45)m	30.5734	26.9293	28.3133	24.1636	22.9323	20.1272	19.4636	20.5304	21.0828	24.1535	26.4740	30.1417	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
										Total per year (kWh/year) = Sum(64)m =		2212.9335	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	84.5557	74.8537	79.5459	69.8059	67.6179	60.8584	59.9291	62.2937	62.9767	70.3250	74.9273	83.5988	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.0400	16.0230	13.0308	9.8651	7.3743	6.2257	6.7271	8.7441	11.7363	14.9020	17.3928	18.5414	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	225.4877	227.8276	221.9312	209.3786	193.5331	178.6406	168.6914	166.3516	172.2479	184.8006	200.6461	215.5386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	(71)
Water heating gains (Table 5)	113.6501	111.3894	106.9165	96.9526	90.8842	84.5256	80.5498	83.7281	87.4676	94.5228	104.0656	112.3640	(72)
Total internal gains	438.9885	437.0507	423.6892	398.0070	373.6023	351.2025	337.7790	340.6346	353.2626	376.0361	403.9152	428.2547	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.1800	36.7938	0.6300	0.8270	0.7700	95.3847	(77)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	95.3847	162.4755	222.3060	275.4479	308.5246	306.2935	295.2996	270.6229	240.7104	179.5700	114.2489	81.6294	(83)
Total gains	534.3732	599.5261	645.9952	673.4549	682.1269	657.4960	633.0787	611.2575	593.9730	555.6061	518.1641	509.8842	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	119.4661	120.0575	120.6548	123.7327	124.3672	127.6399	127.6399	128.3152	126.3104	124.3672	123.1046	121.8674	
alpha	8.9644	9.0038	9.0437	9.2488	9.2911	9.5093	9.5093	9.5543	9.4207	9.2911	9.2070	9.1245	
util living area													
	0.7364	0.6385	0.5337	0.4172	0.3150	0.2192	0.1565	0.1685	0.2643	0.4324	0.6230	0.7582	(86)
MIT	20.9763	20.9925	20.9984	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9998	20.9952	20.9723	(87)
Th 2	20.5509	20.5531	20.5552	20.5658	20.5679	20.5786	20.5786	20.5807	20.5743	20.5679	20.5637	20.5594	(88)
util rest of house													
	0.7191	0.6215	0.5176	0.4023	0.3004	0.2047	0.1415	0.1532	0.2480	0.4145	0.6041	0.7412	(89)
MIT 2	20.5262	20.5454	20.5536	20.5657	20.5679	20.5786	20.5786	20.5807	20.5743	20.5678	20.5590	20.5303	(90)
Living area fraction										fLA = Living area / (4) =		0.5577	(91)
MIT	20.7772	20.7947	20.8017	20.8078	20.8089	20.8136	20.8136	20.8146	20.8117	20.8087	20.8023	20.7768	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7772	20.7947	20.8017	20.8078	20.8089	20.8136	20.8136	20.8146	20.8117	20.8087	20.8023	20.7768	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7279	0.6307	0.5265	0.4106	0.3086	0.2128	0.1499	0.1617	0.2571	0.4245	0.6145	0.7496	(94)
Useful gains	388.9493	378.1202	340.1402	276.5199	210.4753	139.8957	94.8669	98.8679	152.7007	235.8447	318.4121	382.2343	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	396.3568	380.4615	340.6345	276.5633	210.4779	139.8957	94.8669	98.8679	152.7010	235.8921	319.8646	390.8946	(97)
Space heating kWh													
	5.5112	1.5734	0.3677	0.0312	0.0019	0.0000	0.0000	0.0000	0.0000	0.0353	1.0458	6.4433	(98a)
Space heating requirement - total per year (kWh/year)												15.0098	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	5.5112	1.5734	0.3677	0.0312	0.0019	0.0000	0.0000	0.0000	0.0000	0.0353	1.0458	6.4433	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												15.0098	
Space heating per m2											(98c) / (4) =	0.2916	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	5.5112	1.5734	0.3677	0.0312	0.0019	0.0000	0.0000	0.0000	0.0000	0.0353	1.0458	6.4433	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	5.5112	1.5734	0.3677	0.0312	0.0019	0.0000	0.0000	0.0000	0.0000	0.0353	1.0458	6.4433	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9614	8.0942	8.9614	8.6723	8.9614	8.6723	8.9614	8.9614	8.6723	8.9614	8.6723	8.9614	(231)
Lighting	15.7903	12.6676	11.4058	8.3564	6.4547	5.2735	5.8882	7.6537	9.9414	13.0436	14.7327	16.2292	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.3154	-19.6265	-32.0704	-40.6558	-47.9515	-46.2222	-45.4932	-40.9903	-33.3787	-24.2219	-14.2578	-10.3758	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4519	-5.6891	-12.5419	-20.8309	-29.1333	-29.9374	-29.5087	-23.8582	-16.2754	-8.5760	-3.3980	-1.8838	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	15.0098	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2212.9335	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	105.5134	(230a)
Total electricity for the above, kWh/year	105.5134	(231)
Electricity for lighting (calculated in Appendix L)	127.4370	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-551.6441	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1909.2497	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	15.0098	16.4900	2.4751	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	16.4900	364.9127	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	105.5134	16.4900	17.3992	(249)
Energy for lighting	127.4370	16.4900	21.0144	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.5595	16.4900	-60.6106	
PV Unit electricity exported	-184.0846	5.5900	-10.2903	
Total			-70.9009	(252)
Total energy cost			334.9005	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2496	(257)
SAP value		79.7435	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	15.0098	0.1615	2.4240	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2212.9335	0.1413	312.5953	(264)
Space and water heating			315.0193	(265)
Pumps, fans and electric keep-hot	105.5134	0.1387	14.6360	(267)
Energy for lighting	127.4370	0.1443	18.3931	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.5595	0.1322	-48.5957	
PV Unit electricity exported	-184.0846	0.1235	-22.7278	
Total			-71.3235	(269)
Total CO2, kg/year			276.7250	(272)
CO2 emissions per m2			5.3800	(273)
EI value			96.1566	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		51.4800 (1b)	x	2.4000 (2b)	=	123.5520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.4800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	123.5520	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.1800	1.2357	8.8726			(27)
External Wall 1	15.7900	7.1800	8.6100	0.1400	1.2054	14.0000	120.5400	(29a)
Total net area of external elements Aum(A, m2)			15.7900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.0780			(33)
Party Wall 1			47.5200	0.0000	0.0000	20.0000	950.4000	(32)
Wall to corridor			15.8000	0.0000	0.0000	20.0000	316.0000	(32)
Party Floor 1			51.4800			80.0000	4118.4000	(32d)
Party Ceiling 1			51.4800			80.0000	4118.4000	(32b)
Internal Wall 1			80.1900			9.0000	721.7100	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 10345.4500 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 200.9606 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	3.0900	0.0500	0.1545
E4	Jamb	18.5600	0.0500	0.9280
E7	Party floor between dwellings (in blocks of flats)	11.7000	0.0700	0.8190
E18	Party wall between dwellings	5.4000	0.0600	0.3240
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	46.9000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.2255 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 12.3035 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.8698	11.8698	11.6328	10.9218	10.8033	10.3294	10.0924	10.0924	10.5664	11.1588	11.3958	11.2773	(38)
Heat transfer coeff	24.1733	24.1733	23.9363	23.2254	23.1069	22.6329	22.3959	22.3959	22.8699	23.4624	23.6993	23.5808	(39)

Average = Sum(39)m / 12 = 23.3044

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4696	0.4696	0.4650	0.4512	0.4489	0.4396	0.4350	0.4350	0.4442	0.4558	0.4604	0.4581	(40)
HLP (average)												0.4527	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7337 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.2716	72.1705	70.5659	67.4959	65.2303	62.7037	61.2676	62.8600	64.6056	67.3184	70.4543	72.9909	(42a)
Hot water usage for baths	23.0390	22.6968	22.2150	21.3266	20.6614	19.9237	19.5253	20.0037	20.5247	21.3140	22.2207	22.9611	(42b)
Hot water usage for other uses	32.3851	31.2075	30.0298	28.8522	27.6746	26.4969	26.4969	27.6746	28.8522	30.0298	31.2075	32.3851	(42c)

Average daily hot water use (litres/day) 118.3558 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.6957	126.0748	122.8108	117.6747	113.5662	109.1243	107.2898	110.5383	113.9825	118.6622	123.8825	128.3371	(44)
Energy conte	203.8226	179.5288	188.7556	161.0907	152.8819	134.1811	129.7577	136.8695	140.5518	161.0235	176.4934	200.9449	(45)
Energy content (annual)										Total = Sum(45)m =		1965.9015	
Distribution loss (46)m = 0.15 x (45)m	30.5734	26.9293	28.3133	24.1636	22.9323	20.1272	19.4636	20.5304	21.0828	24.1535	26.4740	30.1417	(46)

Water storage loss:

Store volume 143.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)

Temperature factor from Table 2b 0.6000 (49)

Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
										Total per year (kWh/year) = Sum(64)m =		2212.9335	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	84.5557	74.8537	79.5459	69.8059	67.6179	60.8584	59.9291	62.2937	62.9767	70.3250	74.9273	83.5988	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.0400	16.0230	13.0308	9.8651	7.3743	6.2257	6.7271	8.7441	11.7363	14.9020	17.3928	18.5414	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	225.4877	227.8276	221.9312	209.3786	193.5331	178.6406	168.6914	166.3516	172.2479	184.8006	200.6461	215.5386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	(71)
Water heating gains (Table 5)													
	113.6501	111.3894	106.9165	96.9526	90.8842	84.5256	80.5498	83.7281	87.4676	94.5228	104.0656	112.3640	(72)
Total internal gains													
	438.9885	437.0507	423.6892	398.0070	373.6023	351.2025	337.7790	340.6346	353.2626	376.0361	403.9152	428.2547	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.1800	33.4622	0.6300	0.8270	0.7700	86.7478	(77)

Solar gains	86.7478	157.7089	225.5139	293.9220	325.8839	314.4382	306.9161	273.5144	241.9971	173.2574	106.7816	75.9203	(83)
Total gains	525.7363	594.7595	649.2030	691.9290	699.4862	665.6408	644.6951	614.1490	595.2597	549.2935	510.6969	504.1750	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	118.8805	118.8805	120.0575	123.7327	124.3672	126.9717	128.3152	128.3152	125.6559	122.4829	121.2581	121.8674	
alpha	8.9254	8.9254	9.0038	9.2488	9.2911	9.4648	9.5543	9.5543	9.3771	9.1655	9.0839	9.1245	
util living area													
	0.7646	0.6717	0.5663	0.4396	0.3402	0.2652	0.2119	0.2261	0.3150	0.4823	0.6625	0.7838	(86)
MIT	20.9671	20.9880	20.9972	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9995	20.9914	20.9630	(87)
Th 2	20.5488	20.5488	20.5531	20.5658	20.5679	20.5765	20.5807	20.5807	20.5722	20.5616	20.5573	20.5594	(88)
util rest of house													
	0.7477	0.6548	0.5502	0.4251	0.3260	0.2508	0.1973	0.2108	0.2986	0.4637	0.6432	0.7676	(89)
MIT 2	20.5142	20.5364	20.5502	20.5656	20.5679	20.5765	20.5807	20.5807	20.5722	20.5611	20.5488	20.5201	(90)
Living area fraction										fLA = Living area / (4) =		0.5577	(91)
MIT	20.7668	20.7882	20.7995	20.8077	20.8089	20.8127	20.8146	20.8146	20.8108	20.8056	20.7957	20.7671	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7668	20.7882	20.7995	20.8077	20.8089	20.8127	20.8146	20.8146	20.8108	20.8056	20.7957	20.7671	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7560	0.6638	0.5591	0.4332	0.3339	0.2588	0.2055	0.2193	0.3078	0.4741	0.6536	0.7753	(94)
Useful gains	397.4347	394.8120	362.9474	299.7121	233.5787	172.2963	132.4618	134.7013	183.2034	260.4161	333.7988	390.8856	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	407.7262	398.5754	363.8201	299.7864	233.5845	172.2967	132.4618	134.7014	183.2055	260.5634	336.4279	402.4571	(97)
Space heating kWh													
	7.6569	2.5290	0.6493	0.0535	0.0043	0.0000	0.0000	0.0000	0.0000	0.1096	1.8930	8.6092	(98a)
Space heating requirement - total per year (kWh/year)												21.5047	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	7.6569	2.5290	0.6493	0.0535	0.0043	0.0000	0.0000	0.0000	0.0000	0.1096	1.8930	8.6092	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												21.5047	
Space heating per m2											(98c) / (4) =	0.4177	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	7.6569	2.5290	0.6493	0.0535	0.0043	0.0000	0.0000	0.0000	0.0000	0.1096	1.8930	8.6092	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	7.6569	2.5290	0.6493	0.0535	0.0043	0.0000	0.0000	0.0000	0.0000	0.1096	1.8930	8.6092	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9614	8.0942	8.9614	8.6723	8.9614	8.6723	8.9614	8.9614	8.6723	8.9614	8.6723	8.9614	(231)

Lighting	15.7903	12.6676	11.4058	8.3564	6.4547	5.2735	5.8882	7.6537	9.9414	13.0436	14.7327	16.2292	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.1522	-18.8764	-32.0650	-42.3938	-49.6646	-46.9045	-46.5633	-41.0029	-33.1560	-23.1966	-13.2485	-9.5863	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.0831	-5.3234	-12.5320	-22.4565	-31.0910	-30.7709	-30.8244	-23.8716	-16.0831	-7.9676	-3.0096	-1.6542	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	21.5047	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2212.9335	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	105.5134	(230a)
Total electricity for the above, kWh/year	105.5134	(231)
Electricity for lighting (calculated in Appendix L)	127.4370	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-555.4776	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1911.9110	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	21.5047	25.1600	5.4106	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	25.1600	556.7741	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	105.5134	25.1600	26.5472	(249)
Energy for lighting	127.4370	25.1600	32.0632	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.8101	25.1600	-92.5410	
PV Unit electricity exported	-187.6675	5.8100	-10.9035	
Total			-103.4445	(252)
Total energy cost			517.3505	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	21.5047	0.1611	3.4643	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2212.9335	0.1413	312.5953	(264)
Space and water heating			316.0596	(265)
Pumps, fans and electric keep-hot	105.5134	0.1387	14.6360	(267)
Energy for lighting	127.4370	0.1443	18.3931	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.8101	0.1319	-48.5143	
PV Unit electricity exported	-187.6675	0.1230	-23.0802	
Total			-71.5945	(269)
Total CO2, kg/year			277.4943	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	21.5047	1.5961	34.3245	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	1.5223	3368.8373	(278)
Space and water heating			3403.1618	(279)
Pumps, fans and electric keep-hot	105.5134	1.5128	159.6207	(281)
Energy for lighting	127.4370	1.5338	195.4672	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.8101	1.4873	-547.0566	
PV Unit electricity exported	-187.6675	0.4514	-84.7039	
Total			-631.7605	(283)
Total Primary energy kWh/year			3126.4891	(286)

SAP 10 EPC IMPROVEMENTS

Unit 124 L06_Copy

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 80
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£621	£621	£0
Space heating	£32	£32	£0
Water heating	£557	£557	£0
Lighting	£32	£32	£0
Generated (PV)	-£103	-£103	£0
Total cost of fuels	£518	£518	£0
Total cost of uses	£518	£518	£0
Delivered energy	37 kWh/m²	37 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	61 kWh/m²	61 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.4800 (1b)	x	2.4000 (2b)	=	123.5520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.4800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	123.5520	(5)

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2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.1800	1.2357	8.8726			(27)
External Wall 1	15.7900	7.1800	8.6100	0.1400	1.2054	14.0000	120.5400	(29a)
Total net area of external elements Aum(A, m2)			15.7900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.0780			(33)
Party Wall 1			47.5200	0.0000	0.0000	20.0000	950.4000	(32)
Wall to corridor			15.8000	0.0000	0.0000	20.0000	316.0000	(32)
Party Floor 1			51.4800			80.0000	4118.4000	(32d)
Party Ceiling 1			51.4800			80.0000	4118.4000	(32b)
Internal Wall 1			80.1900			9.0000	721.7100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10345.4500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		200.9606 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.0900	0.0500	0.1545
E4 Jamb	18.5600	0.0500	0.9280
E7 Party floor between dwellings (in blocks of flats)	11.7000	0.0700	0.8190
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	46.9000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		2.2255 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	12.3035 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.7513	11.6328	11.5143	10.9218	10.8033	10.2109	10.2109	10.0924	10.4479	10.8033	11.0403	11.2773	(38)
Heat transfer coeff	24.0548	23.9363	23.8178	23.2254	23.1069	22.5144	22.5144	22.3959	22.7514	23.1069	23.3439	23.5808	(39)
Average = Sum(39)m / 12 =												23.1957	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4673	0.4650	0.4627	0.4512	0.4489	0.4373	0.4373	0.4350	0.4419	0.4489	0.4535	0.4581	(40)
HLP (average)												0.4506	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.7337 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.2716	72.1705	70.5659	67.4959	65.2303	62.7037	61.2676	62.8600	64.6056	67.3184	70.4543	72.9909	(42a)

Hot water usage for baths

23.0390	22.6968	22.2150	21.3266	20.6614	19.9237	19.5253	20.0037	20.5247	21.3140	22.2207	22.9611	(42b)

Hot water usage for other uses

32.3851	31.2075	30.0298	28.8522	27.6746	26.4969	26.4969	27.6746	28.8522	30.0298	31.2075	32.3851	(42c)

Average daily hot water use (litres/day)		118.3558 (43)

Daily hot water use

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
128.6957	126.0748	122.8108	117.6747	113.5662	109.1243	107.2898	110.5383	113.9825	118.6622	123.8825	128.3371	(44)
Energy conte 203.8226	179.5288	188.7556	161.0907	152.8819	134.1811	129.7577	136.8695	140.5518	161.0235	176.4934	200.9449	(45)

Energy content (annual)	Total = Sum(45)m =	1965.9015

Distribution loss (46)m = 0.15 x (45)m

30.5734	26.9293	28.3133	24.1636	22.9323	20.1272	19.4636	20.5304	21.0828	24.1535	26.4740	30.1417	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)

	Total per year (kWh/year) = Sum(64)m =	2212.9335 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000 (64a)

Heat gains from water heating, kWh/month

84.5557	74.8537	79.5459	69.8059	67.6179	60.8584	59.9291	62.2937	62.9767	70.3250	74.9273	83.5988	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.0400	16.0230	13.0308	9.8651	7.3743	6.2257	6.7271	8.7441	11.7363	14.9020	17.3928	18.5414	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	225.4877	227.8276	221.9312	209.3786	193.5331	178.6406	168.6914	166.3516	172.2479	184.8006	200.6461	215.5386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	(71)
Water heating gains (Table 5)	113.6501	111.3894	106.9165	96.9526	90.8842	84.5256	80.5498	83.7281	87.4676	94.5228	104.0656	112.3640	(72)
Total internal gains	438.9885	437.0507	423.6892	398.0070	373.6023	351.2025	337.7790	340.6346	353.2626	376.0361	403.9152	428.2547	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.1800	36.7938	0.6300	0.8270	0.7700	95.3847	(77)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	95.3847	162.4755	222.3060	275.4479	308.5246	306.2935	295.2996	270.6229	240.7104	179.5700	114.2489	81.6294	(83)
Total gains	534.3732	599.5261	645.9952	673.4549	682.1269	657.4960	633.0787	611.2575	593.9730	555.6061	518.1641	509.8842	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	119.4661	120.0575	120.6548	123.7327	124.3672	127.6399	127.6399	128.3152	126.3104	124.3672	123.1046	121.8674	
alpha	8.9644	9.0038	9.0437	9.2488	9.2911	9.5093	9.5093	9.5543	9.4207	9.2911	9.2070	9.1245	
util living area	0.7364	0.6385	0.5337	0.4172	0.3150	0.2192	0.1565	0.1685	0.2643	0.4324	0.6230	0.7582	(86)
MIT	20.9763	20.9925	20.9984	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9998	20.9952	20.9723	(87)
Th 2	20.5509	20.5531	20.5552	20.5658	20.5679	20.5786	20.5786	20.5807	20.5743	20.5679	20.5637	20.5594	(88)
util rest of house	0.7191	0.6215	0.5176	0.4023	0.3004	0.2047	0.1415	0.1532	0.2480	0.4145	0.6041	0.7412	(89)
MIT 2	20.5262	20.5454	20.5536	20.5657	20.5679	20.5786	20.5786	20.5807	20.5743	20.5678	20.5590	20.5303	(90)
Living area fraction									fLA = Living area / (4) =			0.5577	(91)
MIT	20.7772	20.7947	20.8017	20.8078	20.8089	20.8136	20.8136	20.8146	20.8117	20.8087	20.8023	20.7768	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7772	20.7947	20.8017	20.8078	20.8089	20.8136	20.8136	20.8146	20.8117	20.8087	20.8023	20.7768	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7279	0.6307	0.5265	0.4106	0.3086	0.2128	0.1499	0.1617	0.2571	0.4245	0.6145	0.7496	(94)
Useful gains	388.9493	378.1202	340.1402	276.5199	210.4753	139.8957	94.8669	98.8679	152.7007	235.8447	318.4121	382.2343	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	396.3568	380.4615	340.6345	276.5633	210.4779	139.8957	94.8669	98.8679	152.7010	235.8921	319.8646	390.8946	(97)
Space heating kWh	5.5112	1.5734	0.3677	0.0312	0.0019	0.0000	0.0000	0.0000	0.0000	0.0353	1.0458	6.4433	(98a)
Space heating requirement - total per year (kWh/year)												15.0098	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	5.5112	1.5734	0.3677	0.0312	0.0019	0.0000	0.0000	0.0000	0.0000	0.0353	1.0458	6.4433	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												15.0098	
Space heating per m2											(98c) / (4) =	0.2916	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	5.5112	1.5734	0.3677	0.0312	0.0019	0.0000	0.0000	0.0000	0.0000	0.0353	1.0458	6.4433	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	5.5112	1.5734	0.3677	0.0312	0.0019	0.0000	0.0000	0.0000	0.0000	0.0353	1.0458	6.4433	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9614	8.0942	8.9614	8.6723	8.9614	8.6723	8.9614	8.9614	8.6723	8.9614	8.6723	8.9614	(231)
Lighting	15.7903	12.6676	11.4058	8.3564	6.4547	5.2735	5.8882	7.6537	9.9414	13.0436	14.7327	16.2292	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.3154	-19.6265	-32.0704	-40.6558	-47.9515	-46.2222	-45.4932	-40.9903	-33.3787	-24.2219	-14.2578	-10.3758	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4519	-5.6891	-12.5419	-20.8309	-29.1333	-29.9374	-29.5087	-23.8582	-16.2754	-8.5760	-3.3980	-1.8838	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												15.0098	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2212.9335	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	105.5134	(230a)
Total electricity for the above, kWh/year	105.5134	(231)
Electricity for lighting (calculated in Appendix L)	127.4370	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-551.6441	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1909.2497	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	15.0098	16.4900	2.4751	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	16.4900	364.9127	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	105.5134	16.4900	17.3992	(249)
Energy for lighting	127.4370	16.4900	21.0144	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.5595	16.4900	-60.6106	
PV Unit electricity exported	-184.0846	5.5900	-10.2903	
Total			-70.9009	(252)
Total energy cost			334.9005	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2496	(257)
SAP value	79.7435	
SAP rating (Section 12)	80	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	15.0098	0.1615	2.4240	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2212.9335	0.1413	312.5953	(264)
Space and water heating			315.0193	(265)
Pumps, fans and electric keep-hot	105.5134	0.1387	14.6360	(267)
Energy for lighting	127.4370	0.1443	18.3931	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.5595	0.1322	-48.5957	
PV Unit electricity exported	-184.0846	0.1235	-22.7278	
Total			-71.3235	(269)
Total CO2, kg/year			276.7250	(272)
CO2 emissions per m2			5.3800	(273)
EI value			96.1566	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.4800	(1b)	x 2.4000	(2b) =	123.5520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 51.4800						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		123.5520	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 = 0.0000	(6a)
Number of open flues	0 * 20 = 0.0000	(6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.1800	1.2357	8.8726			(27)
External Wall 1	15.7900	7.1800	8.6100	0.1400	1.2054	14.0000	120.5400	(29a)
Total net area of external elements Aum(A, m2)			15.7900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	10.0780			(33)
Party Wall 1			47.5200	0.0000	0.0000	20.0000	950.4000	(32)
Wall to corridor			15.8000	0.0000	0.0000	20.0000	316.0000	(32)
Party Floor 1			51.4800			80.0000	4118.4000	(32d)
Party Ceiling 1			51.4800			80.0000	4118.4000	(32b)
Internal Wall 1			80.1900			9.0000	721.7100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 10345.4500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	200.9606 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.0900	0.0500	0.1545
E4 Jamb	18.5600	0.0500	0.9280
E7 Party floor between dwellings (in blocks of flats)	11.7000	0.0700	0.8190
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	46.9000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		2.2255 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	12.3035 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.8698	11.8698	11.6328	10.9218	10.8033	10.3294	10.0924	10.0924	10.5664	11.1588	11.3958	11.2773	(38)
Heat transfer coeff	24.1733	24.1733	23.9363	23.2254	23.1069	22.6329	22.3959	22.3959	22.8699	23.4624	23.6993	23.5808	(39)
Average = Sum(39)m / 12 =												23.3044	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4696	0.4696	0.4650	0.4512	0.4489	0.4396	0.4350	0.4350	0.4442	0.4558	0.4604	0.4581	(40)
HLP (average)												0.4527	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7337 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.2716	72.1705	70.5659	67.4959	65.2303	62.7037	61.2676	62.8600	64.6056	67.3184	70.4543	72.9909	(42a)
Hot water usage for baths	23.0390	22.6968	22.2150	21.3266	20.6614	19.9237	19.5253	20.0037	20.5247	21.3140	22.2207	22.9611	(42b)
Hot water usage for other uses	32.3851	31.2075	30.0298	28.8522	27.6746	26.4969	26.4969	27.6746	28.8522	30.0298	31.2075	32.3851	(42c)
Average daily hot water use (litres/day)												118.3558	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.6957	126.0748	122.8108	117.6747	113.5662	109.1243	107.2898	110.5383	113.9825	118.6622	123.8825	128.3371	(44)
Energy conte	203.8226	179.5288	188.7556	161.0907	152.8819	134.1811	129.7577	136.8695	140.5518	161.0235	176.4934	200.9449	(45)
Energy content (annual)										Total = Sum(45)m =		1965.9015	
Distribution loss (46)m = 0.15 x (45)m	30.5734	26.9293	28.3133	24.1636	22.9323	20.1272	19.4636	20.5304	21.0828	24.1535	26.4740	30.1417	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
Total per year (kWh/year) = Sum(64)m =												2212.9335	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	84.5557	74.8537	79.5459	69.8059	67.6179	60.8584	59.9291	62.2937	62.9767	70.3250	74.9273	83.5988	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.0400	16.0230	13.0308	9.8651	7.3743	6.2257	6.7271	8.7441	11.7363	14.9020	17.3928	18.5414	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	225.4877	227.8276	221.9312	209.3786	193.5331	178.6406	168.6914	166.3516	172.2479	184.8006	200.6461	215.5386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	(71)
Water heating gains (Table 5)	113.6501	111.3894	106.9165	96.9526	90.8842	84.5256	80.5498	83.7281	87.4676	94.5228	104.0656	112.3640	(72)
Total internal gains	438.9885	437.0507	423.6892	398.0070	373.6023	351.2025	337.7790	340.6346	353.2626	376.0361	403.9152	428.2547	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.1800	33.4622	0.6300	0.8270	0.7700	86.7478	(77)

Solar gains	86.7478	157.7089	225.5139	293.9220	325.8839	314.4382	306.9161	273.5144	241.9971	173.2574	106.7816	75.9203	(83)
Total gains	525.7363	594.7595	649.2030	691.9290	699.4862	665.6408	644.6951	614.1490	595.2597	549.2935	510.6969	504.1750	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	118.8805	118.8805	120.0575	123.7327	124.3672	126.9717	128.3152	128.3152	125.6559	122.4829	121.2581	121.8674	
alpha	8.9254	8.9254	9.0038	9.2488	9.2911	9.4648	9.5543	9.5543	9.3771	9.1655	9.0839	9.1245	
util living area	0.7646	0.6717	0.5663	0.4396	0.3402	0.2652	0.2119	0.2261	0.3150	0.4823	0.6625	0.7838	(86)
MIT	20.9671	20.9880	20.9972	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9995	20.9914	20.9630	(87)
Th 2	20.5488	20.5488	20.5531	20.5658	20.5679	20.5765	20.5807	20.5807	20.5722	20.5616	20.5573	20.5594	(88)
util rest of house	0.7477	0.6548	0.5502	0.4251	0.3260	0.2508	0.1973	0.2108	0.2986	0.4637	0.6432	0.7676	(89)
MIT 2	20.5142	20.5364	20.5502	20.5656	20.5679	20.5765	20.5807	20.5807	20.5722	20.5611	20.5488	20.5201	(90)
Living area fraction										fLA = Living area / (4) =		0.5577	(91)
MIT	20.7668	20.7882	20.7995	20.8077	20.8089	20.8127	20.8146	20.8146	20.8108	20.8056	20.7957	20.7671	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7668	20.7882	20.7995	20.8077	20.8089	20.8127	20.8146	20.8146	20.8108	20.8056	20.7957	20.7671	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7560	0.6638	0.5591	0.4332	0.3339	0.2588	0.2055	0.2193	0.3078	0.4741	0.6536	0.7753	(94)
Useful gains	397.4347	394.8120	362.9474	299.7121	233.5787	172.2963	132.4618	134.7013	183.2034	260.4161	333.7988	390.8856	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	407.7262	398.5754	363.8201	299.7864	233.5845	172.2967	132.4618	134.7014	183.2055	260.5634	336.4279	402.4571	(97)
Space heating kWh	7.6569	2.5290	0.6493	0.0535	0.0043	0.0000	0.0000	0.0000	0.0000	0.1096	1.8930	8.6092	(98a)
Space heating requirement - total per year (kWh/year)												21.5047	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	7.6569	2.5290	0.6493	0.0535	0.0043	0.0000	0.0000	0.0000	0.0000	0.1096	1.8930	8.6092	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												21.5047	
Space heating per m2											(98c) / (4) =	0.4177	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	7.6569	2.5290	0.6493	0.0535	0.0043	0.0000	0.0000	0.0000	0.0000	0.1096	1.8930	8.6092	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													

	7.6569	2.5290	0.6493	0.0535	0.0043	0.0000	0.0000	0.0000	0.0000	0.1096	1.8930	8.6092 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	8.9614	8.0942	8.9614	8.6723	8.9614	8.6723	8.9614	8.9614	8.6723	8.9614	8.6723	8.9614 (231)
Lighting	15.7903	12.6676	11.4058	8.3564	6.4547	5.2735	5.8882	7.6537	9.9414	13.0436	14.7327	16.2292 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-11.1522	-18.8764	-32.0650	-42.3938	-49.6646	-46.9045	-46.5633	-41.0029	-33.1560	-23.1966	-13.2485	-9.5863 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.0831	-5.3234	-12.5320	-22.4565	-31.0910	-30.7709	-30.8244	-23.8716	-16.0831	-7.9676	-3.0096	-1.6542 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	21.5047 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2212.9335 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	105.5134 (230a)
Total electricity for the above, kWh/year	105.5134 (231)
Electricity for lighting (calculated in Appendix L)	127.4370 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-555.4776 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1911.9110 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	21.5047	25.1600	5.4106	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	25.1600	556.7741	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	105.5134	25.1600	26.5472	(249)
Energy for lighting	127.4370	25.1600	32.0632	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.8101	25.1600	-92.5410	
PV Unit electricity exported	-187.6675	5.8100	-10.9035	
Total			-103.4445	(252)
Total energy cost			517.3505	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	21.5047	0.1611	3.4643	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2212.9335	0.1413	312.5953	(264)
Space and water heating			316.0596	(265)
Pumps, fans and electric keep-hot	105.5134	0.1387	14.6360	(267)
Energy for lighting	127.4370	0.1443	18.3931	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.8101	0.1319	-48.5143	
PV Unit electricity exported	-187.6675	0.1230	-23.0802	
Total			-71.5945	(269)
Total CO2, kg/year			277.4943	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	21.5047	1.5961	34.3245	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	1.5223	3368.8373	(278)
Space and water heating			3403.1618	(279)

Pumps, fans and electric keep-hot	105.5134	1.5128	159.6207	(281)
Energy for lighting	127.4370	1.5338	195.4672	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.8101	1.4873	-547.0566	
PV Unit electricity exported	-187.6675	0.4514	-84.7039	
Total			-631.7605	(283)
Total Primary energy kWh/year			3126.4891	(286)

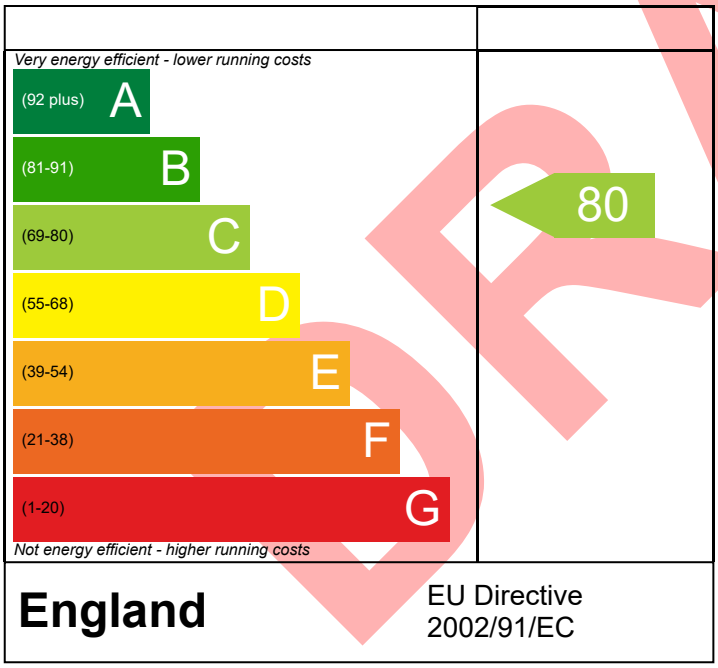
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	51.48 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

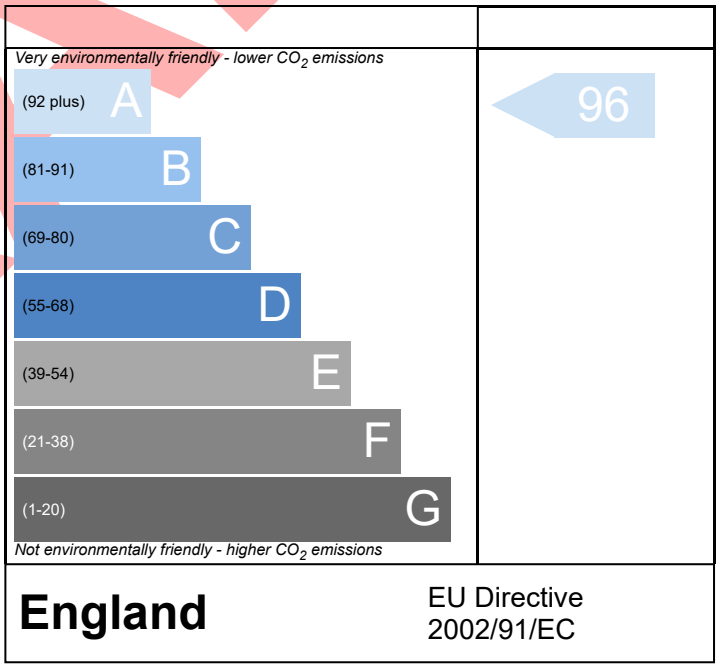
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:22

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	66 m^2
Site Reference	Unit 125 L06_Copy	Plot Reference	Unit 125 L06_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*12.26 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	5.89 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*66.22 kWh$_{PE}$/m^2*	
Dwelling primary energy	65.18 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*26.2 kWh/m^2*	
Dwelling fabric energy efficiency	26.0 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	23.28	0.14 **(!)**
Party wall: Party Wall (1)	30.24	0 **(!)**
Party wall: Party Wall (2)	14.18	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	7.18	North East	0.83	1.3
N, Opening Type 1	3.59	North	0.83	1.3
NW, Opening Type 1	7.18	North West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.85 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 125 L06_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 125 L06_Copy	**Prop Type Ref**	Unit 125 L06
Property			

SAP Rating	77 C	**DER**	5.89	**TER**	12.26
Environmental	95 A	**% DER < TER**			51.96
CO_2 Emissions (t/year)	0.39	**DFEE**	25.97	**TFEE**	26.21
Compliance Check	See BREL	**% DFEE < TFEE**			0.92
% DPER < TPER	1.57	**DPER**	65.18	**TPER**	66.22

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.6000 (1b)	x	2.4000 (2b)	=	157.4400	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.6000					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	157.4400	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			17.9500	1.2357	22.1816			(27)
External Wall 1	41.2300	17.9500	23.2800	0.1400	3.2592	14.0000	325.9200	(29a)
Total net area of external elements Aum(A, m2)			41.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.4408			(33)
Party Wall 1			30.2400	0.0000	0.0000	20.0000	604.8000	(32)
Wall to corridor			14.1800	0.0000	0.0000	20.0000	283.6000	(32)
Party Floor 1			65.6000			80.0000	5248.0000	(32d)
Party Ceiling 1			65.6000			80.0000	5248.0000	(32b)
Internal Wall 1			114.4800			9.0000	1030.3200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12740.6400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		194.2171 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	7.8800	0.0500	0.3940

E4 Jamb	23.2000	0.0500	1.1600	
E7 Party floor between dwellings (in blocks of flats)	30.5400	0.0700	2.1378	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	32.9000	0.0000	0.0000	
E16 Corner (normal)	5.4000	0.0900	0.4860	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.5018 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 29.9426 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.7197	15.5541	15.3885	14.5604	14.3948	13.5668	13.5668	13.4012	13.8980	14.3948	14.7261	15.0573	(38)
Heat transfer coeff	45.6623	45.4966	45.3310	44.5030	44.3374	43.5094	43.5094	43.3438	43.8406	44.3374	44.6686	44.9998	(39)
Average = Sum(39)m / 12 =												44.4616	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6961	0.6935	0.6910	0.6784	0.6759	0.6633	0.6633	0.6607	0.6683	0.6759	0.6809	0.6860	(40)
HLP (average)												0.6778	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1348 (42)

Hot water usage for mixer showers

82.5173	81.2772	79.4702	76.0128	73.4613	70.6159	68.9985	70.7919	72.7577	75.8128	79.3445	82.2011	(42a)

Hot water usage for baths

25.9306	25.5455	25.0032	24.0033	23.2545	22.4243	21.9759	22.5144	23.1007	23.9891	25.0096	25.8429	(42b)

Hot water usage for other uses

36.4921	35.1651	33.8381	32.5112	31.1842	29.8572	29.8572	31.1842	32.5112	33.8381	35.1651	36.4921	(42c)

Average daily hot water use (litres/day) 133.2946 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.9400	141.9879	138.3115	132.5272	127.9000	122.8974	120.8316	124.4905	128.3696	133.6401	139.5193	144.5362	(44)
Energy conte	229.5496	202.1888	212.5797	181.4231	172.1780	151.1167	146.1353	154.1452	158.2926	181.3483	198.7708	226.3088	(45)
Energy content (annual)										Total = Sum(45)m =		2214.0368	

Distribution loss (46)m = 0.15 x (45)m

34.4324	30.3283	31.8870	27.2135	25.8267	22.6675	21.9203	23.1218	23.7439	27.2023	29.8156	33.9463	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
									Total per year (kWh/year) = Sum(64)m =		2461.0688	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

93.1099	82.3881	87.4674	76.5664	74.0338	66.4895	65.3746	68.0379	68.8755	77.0830	82.3345	92.0323	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.5047	19.1002	15.5334	11.7598	8.7906	7.4214	8.0190	10.4234	13.9903	17.7639	20.7331	22.1023	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	278.8333	281.7267	274.4354	258.9131	239.3189	220.9031	208.6002	205.7068	212.9981	228.5205	248.1147	266.5304	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(70)
Losses e.g. evaporation (negative values) (Table 5)	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	(71)
Water heating gains (Table 5)	125.1477	122.6013	117.5637	106.3422	99.5078	92.3465	87.8691	91.4488	95.6604	103.6061	114.3535	123.6993	(72)
Total internal gains	518.1243	516.0669	500.1711	469.6536	440.2559	413.3096	397.1270	400.2177	415.2875	442.5292	475.8399	504.9707	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5900	10.6334	0.6300	0.8270	0.7700	13.7831	(74)
Northeast	7.1800	11.2829	0.6300	0.8270	0.7700	29.2500	(75)
Northwest	7.1800	11.2829	0.6300	0.8270	0.7700	29.2500	(81)

Solar gains	72.2831	145.4186	259.2999	424.2322	570.4595	608.5987	569.1396	453.3531	315.2363	176.8778	90.6113	59.2643	(83)
Total gains	590.4074	661.4856	759.4710	893.8859	1010.7154	1021.9082	966.2666	853.5708	730.5238	619.4070	566.4512	564.2350	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	77.5053	77.7874	78.0716	79.5242	79.8213	81.3404	81.3404	81.6511	80.7258	79.8213	79.2294	78.6462	
alpha	6.1670	6.1858	6.2048	6.3016	6.3214	6.4227	6.4227	6.4434	6.3817	6.3214	6.2820	6.2431	
util living area	0.9445	0.9007	0.7920	0.5923	0.4071	0.2724	0.1981	0.2336	0.4132	0.7111	0.8989	0.9536	(86)
MIT	20.5481	20.6983	20.8768	20.9801	20.9981	20.9999	21.0000	21.0000	20.9986	20.9543	20.7527	20.5181	(87)
Th 2	20.3443	20.3465	20.3488	20.3600	20.3622	20.3734	20.3734	20.3757	20.3689	20.3622	20.3577	20.3532	(88)
util rest of house	0.9348	0.8855	0.7677	0.5633	0.3795	0.2458	0.1699	0.2019	0.3758	0.6752	0.8811	0.9452	(89)
MIT 2	19.8330	20.0151	20.2220	20.3415	20.3607	20.3733	20.3734	20.3756	20.3680	20.3207	20.0932	19.8041	(90)
Living area fraction										fLA = Living area / (4) =		0.4663	(91)
MIT	20.1664	20.3337	20.5274	20.6393	20.6579	20.6655	20.6656	20.6668	20.6620	20.6162	20.4008	20.1371	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1664	20.3337	20.5274	20.6393	20.6579	20.6655	20.6656	20.6668	20.6620	20.6162	20.4008	20.1371	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9319	0.8852	0.7746	0.5761	0.3923	0.2582	0.1831	0.2167	0.3932	0.6898	0.8824	0.9421	(94)
Useful gains	550.2067	585.5253	588.2574	514.9257	396.5134	263.8737	176.8884	184.9303	287.2268	427.2788	499.8158	531.5653	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	724.4972	702.1815	635.8746	522.4329	397.1716	263.9064	176.8911	184.9379	287.6830	444.0905	594.1261	717.1646	(97)
Space heating kWh	129.6722	78.3929	35.4272	5.4052	0.4897	0.0000	0.0000	0.0000	0.0000	12.5079	67.9035	138.0859	(98a)
Space heating requirement - total per year (kWh/year)												467.8846	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	129.6722	78.3929	35.4272	5.4052	0.4897	0.0000	0.0000	0.0000	0.0000	12.5079	67.9035	138.0859	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												467.8846	
Space heating per m2										(98c) / (4) =		7.1324	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 100.0000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	129.6722	78.3929	35.4272	5.4052	0.4897	0.0000	0.0000	0.0000	0.0000	12.5079	67.9035	138.0859	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	129.6722	78.3929	35.4272	5.4052	0.4897	0.0000	0.0000	0.0000	0.0000	12.5079	67.9035	138.0859	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	12.1045	10.9331	12.1045	11.7141	12.1045	11.7141	12.1045	12.1045	11.7141	12.1045	11.7141	12.1045	(231)
Lighting	18.8229	15.1004	13.5963	9.9612	7.6943	6.2863	7.0190	9.1236	11.8506	15.5487	17.5622	19.3460	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.8109	-25.1338	-40.6028	-50.8141	-59.6203	-57.3843	-56.4723	-50.9617	-41.6122	-30.4670	-18.1973	-13.3238	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.9238	-6.9830	-15.9948	-27.1915	-38.1738	-39.2360	-38.6794	-31.3088	-21.3818	-11.1424	-4.2019	-2.2294	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year
Space heating fuel - main system 1 467.8846 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 100.0000
Water heating fuel used 2461.0688 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)
mechanical ventilation fans (SFP = 0.7420) 142.5210 (230a)
Total electricity for the above, kWh/year 142.5210 (231)
Electricity for lighting (calculated in Appendix L) 151.9116 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation -699.8470 (233)
Wind generation 0.0000 (234)

Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2523.5390	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	467.8846	16.4900	77.1542	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	16.4900	405.8302	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	142.5210	16.4900	23.5017	(249)
Energy for lighting	151.9116	16.4900	25.0502	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.4004	16.4900	-75.9200	
PV Unit electricity exported	-239.4465	5.5900	-13.3851	
Total			-89.3051	(252)
Total energy cost			442.2312	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.4395	(257)
SAP value	76.6665	
SAP rating (Section 12)	77	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	467.8846	0.1590	74.3999	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2461.0688	0.1413	347.7259	(264)
Space and water heating			422.1258	(265)
Pumps, fans and electric keep-hot	142.5210	0.1387	19.7694	(267)
Energy for lighting	151.9116	0.1443	21.9255	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.4004	0.1324	-60.9491	
PV Unit electricity exported	-239.4465	0.1230	-29.4518	
Total			-90.4010	(269)
Total CO2, kg/year			373.4198	(272)
CO2 emissions per m2			5.6900	(273)
EI value			95.4757	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.6000	(1b)	x 2.4000	(2b) =	157.4400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		157.4400	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			17.9500	1.2357	22.1816			(27)
External Wall 1	41.2300	17.9500	23.2800	0.1400	3.2592	14.0000	325.9200	(29a)
Total net area of external elements Aum(A, m2)			41.2300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.4408			(33)
Party Wall 1			30.2400	0.0000	0.0000	20.0000	604.8000	(32)
Wall to corridor			14.1800	0.0000	0.0000	20.0000	283.6000	(32)
Party Floor 1			65.6000			80.0000	5248.0000	(32d)
Party Ceiling 1			65.6000			80.0000	5248.0000	(32b)
Internal Wall 1			114.4800			9.0000	1030.3200	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12740.6400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 194.2171 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	7.8800	0.0500	0.3940
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	30.5400	0.0700	2.1378
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	32.9000	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.5018 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 29.9426 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.8853	15.8853	15.5541	14.5604	14.3948	13.7324	13.4012	13.4012	14.0636	14.8917	15.2229	15.0573	(38)
Heat transfer coeff	45.8279	45.8279	45.4966	44.5030	44.3374	43.6750	43.3438	43.3438	44.0062	44.8342	45.1654	44.9998	(39)
Average = Sum(39)m / 12 =												44.6134	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6986	0.6986	0.6935	0.6784	0.6759	0.6658	0.6607	0.6607	0.6708	0.6834	0.6885	0.6860	(40)
HLP (average)												0.6801	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1348 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	82.5173	81.2772	79.4702	76.0128	73.4613	70.6159	68.9985	70.7919	72.7577	75.8128	79.3445	82.2011	(42a)
Hot water usage for baths	25.9306	25.5455	25.0032	24.0033	23.2545	22.4243	21.9759	22.5144	23.1007	23.9891	25.0096	25.8429	(42b)
Hot water usage for other uses	36.4921	35.1651	33.8381	32.5112	31.1842	29.8572	29.8572	31.1842	32.5112	33.8381	35.1651	36.4921	(42c)
Average daily hot water use (litres/day)												133.2946	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.9400	141.9879	138.3115	132.5272	127.9000	122.8974	120.8316	124.4905	128.3696	133.6401	139.5193	144.5362	(44)
Energy conte	229.5496	202.1888	212.5797	181.4231	172.1780	151.1167	146.1353	154.1452	158.2926	181.3483	198.7708	226.3088	(45)
Energy content (annual)										Total = Sum(45)m =		2214.0368	
Distribution loss (46)m = 0.15 x (45)m	34.4324	30.3283	31.8870	27.2135	25.8267	22.6675	21.9203	23.1218	23.7439	27.2023	29.8156	33.9463	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
										Total per year (kWh/year) = Sum(64)m =		2461.0688	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month	93.1099	82.3881	87.4674	76.5664	74.0338	66.4895	65.3746	68.0379	68.8755	77.0830	82.3345	92.0323	(65)

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5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.5047	19.1002	15.5334	11.7598	8.7906	7.4214	8.0190	10.4234	13.9903	17.7639	20.7331	22.1023	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	278.8333	281.7267	274.4354	258.9131	239.3189	220.9031	208.6002	205.7068	212.9981	228.5205	248.1147	266.5304	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	(71)
Water heating gains (Table 5)													
	125.1477	122.6013	117.5637	106.3422	99.5078	92.3465	87.8691	91.4488	95.6604	103.6061	114.3535	123.6993	(72)
Total internal gains													
	518.1243	516.0669	500.1711	469.6536	440.2559	413.3096	397.1270	400.2177	415.2875	442.5292	475.8399	504.9707	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5900	9.5462	0.6300	0.8270	0.7700	12.3738	(74)
Northeast	7.1800	10.0309	0.6300	0.8270	0.7700	26.0043	(75)
Northwest	7.1800	10.0309	0.6300	0.8270	0.7700	26.0043	(81)

Solar gains	64.3824	137.7004	255.9710	441.5733	590.5612	614.0120	580.6227	447.7696	308.5106	166.2493	82.8380	54.0541	(83)
Total gains	582.5066	653.7673	756.1421	911.2269	1030.8171	1027.3216	977.7498	847.9874	723.7981	608.7785	558.6779	559.0248	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	77.2252	77.2252	77.7874	79.5242	79.8213	81.0319	81.6511	81.6511	80.4220	78.9367	78.3579	78.6462	
alpha	6.1483	6.1483	6.1858	6.3016	6.3214	6.4021	6.4434	6.4434	6.3615	6.2624	6.2239	6.2431	
util living area													
	0.9529	0.9181	0.8260	0.6254	0.4416	0.3314	0.2704	0.3168	0.4955	0.7722	0.9178	0.9608	(86)
MIT	20.4962	20.6361	20.8321	20.9710	20.9967	20.9996	20.9999	20.9998	20.9952	20.9192	20.6960	20.4663	(87)
Th 2	20.3421	20.3421	20.3465	20.3600	20.3622	20.3712	20.3757	20.3757	20.3667	20.3555	20.3510	20.3532	(88)
util rest of house													
	0.9446	0.9052	0.8045	0.5978	0.4146	0.3048	0.2427	0.2849	0.4583	0.7400	0.9028	0.9537	(89)
MIT 2	19.7671	19.9366	20.1693	20.3322	20.3594	20.3709	20.3756	20.3755	20.3630	20.2782	20.0201	19.7397	(90)
Living area fraction									fLA = Living area / (4) =			0.4663	(91)
MIT	20.1071	20.2628	20.4784	20.6301	20.6566	20.6640	20.6667	20.6666	20.6578	20.5771	20.3352	20.0785	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1071	20.2628	20.4784	20.6301	20.6566	20.6640	20.6667	20.6666	20.6578	20.5771	20.3352	20.0785	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9412	0.9035	0.8090	0.6096	0.4271	0.3172	0.2556	0.2998	0.4755	0.7514	0.9024	0.9503	(94)
Useful gains	548.2738	590.7065	611.7196	555.4598	440.2617	325.8480	249.9229	254.2044	344.1401	457.4466	504.1336	531.2360	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	742.7367	731.5405	676.9151	566.5280	441.4496	325.9912	249.9512	254.2803	345.7913	487.6664	620.3584	737.0302	(97)
Space heating kWh													
	144.6804	94.6405	48.5055	7.9691	0.8838	0.0000	0.0000	0.0000	0.0000	22.4835	83.6818	153.1109	(98a)
Space heating requirement - total per year (kWh/year)												555.9554	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	144.6804	94.6405	48.5055	7.9691	0.8838	0.0000	0.0000	0.0000	0.0000	22.4835	83.6818	153.1109	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												555.9554	
Space heating per m2											(98c) / (4) =	8.4749	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	144.6804	94.6405	48.5055	7.9691	0.8838	0.0000	0.0000	0.0000	0.0000	22.4835	83.6818	153.1109	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	144.6804	94.6405	48.5055	7.9691	0.8838	0.0000	0.0000	0.0000	0.0000	22.4835	83.6818	153.1109	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
Efficiency of water heater												100.0000	(216)

(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	12.1045	10.9331	12.1045	11.7141	12.1045	11.7141	12.1045	12.1045	11.7141	12.1045	11.7141	12.1045	(231)
Lighting	18.8229	15.1004	13.5963	9.9612	7.6943	6.2863	7.0190	9.1236	11.8506	15.5487	17.5622	19.3460	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.3294	-24.2494	-40.7630	-53.0343	-61.7357	-58.2186	-57.7804	-50.9772	-41.3377	-29.2864	-16.9529	-12.3202	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4617	-6.4520	-15.8152	-29.2384	-40.7154	-40.3248	-40.3981	-31.3264	-21.1298	-10.2503	-3.6730	-1.9401	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	555.9554	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2461.0688	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	142.5210	(230a)
Total electricity for the above, kWh/year	142.5210	(231)
Electricity for lighting (calculated in Appendix L)	151.9116	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-704.7104	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2606.7464	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	555.9554	25.1600	139.8784	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	25.1600	619.2049	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	142.5210	25.1600	35.8583	(249)
Energy for lighting	151.9116	25.1600	38.2210	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.9852	25.1600	-115.9839	
PV Unit electricity exported	-243.7252	5.8100	-14.1604	
Total			-130.1443	(252)
Total energy cost			703.0182	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	555.9554	0.1584	88.0537	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2461.0688	0.1413	347.7259	(264)
Space and water heating			435.7797	(265)
Pumps, fans and electric keep-hot	142.5210	0.1387	19.7694	(267)
Energy for lighting	151.9116	0.1443	21.9255	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.9852	0.1321	-60.8889	
PV Unit electricity exported	-243.7252	0.1225	-29.8480	
Total			-90.7368	(269)
Total CO2, kg/year			386.7378	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	555.9554	1.5863	881.8850	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	1.5225	3746.8812	(278)
Space and water heating			4628.7662	(279)
Pumps, fans and electric keep-hot	142.5210	1.5128	215.6057	(281)
Energy for lighting	151.9116	1.5338	233.0071	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.9852	1.4880	-685.9583	
PV Unit electricity exported	-243.7252	0.4494	-109.5387	
Total			-795.4970	(283)
Total Primary energy kWh/year			4281.8820	(286)

SAP 10 EPC IMPROVEMENTS

Unit 125 L06_Copy

Current energy efficiency rating: C 77
Current environmental impact rating: A 95

N Solar water heating	Not applicable
U Solar photovoltaic panels	Not applicable
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 77
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£833	£833	£0
Space heating	£176	£176	£0
Water heating	£619	£619	£0
Lighting	£38	£38	£0
Generated (PV)	-£130	-£130	£0
Total cost of fuels	£703	£703	£0
Total cost of uses	£703	£703	£0
Delivered energy	40 kWh/m²	40 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	65 kWh/m²	65 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.6000 (1b)	x	2.4000 (2b)	=	157.4400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	157.4400	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			17.9500	1.2357	22.1816			(27)
External Wall 1	41.2300	17.9500	23.2800	0.1400	3.2592	14.0000	325.9200	(29a)
Total net area of external elements Aum(A, m2)			41.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.4408			(33)
Party Wall 1			30.2400	0.0000	0.0000	20.0000	604.8000	(32)
Wall to corridor			14.1800	0.0000	0.0000	20.0000	283.6000	(32)
Party Floor 1			65.6000			80.0000	5248.0000	(32d)
Party Ceiling 1			65.6000			80.0000	5248.0000	(32b)
Internal Wall 1			114.4800			9.0000	1030.3200	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12740.6400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 194.2171 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	7.8800	0.0500	0.3940
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	30.5400	0.0700	2.1378
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	32.9000	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.5018 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 29.9426 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.7197	15.5541	15.3885	14.5604	14.3948	13.5668	13.5668	13.4012	13.8980	14.3948	14.7261	15.0573	(38)
Heat transfer coeff	45.6623	45.4966	45.3310	44.5030	44.3374	43.5094	43.5094	43.3438	43.8406	44.3374	44.6686	44.9998	(39)

Average = Sum(39)m / 12 = 44.4616

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6961	0.6935	0.6910	0.6784	0.6759	0.6633	0.6633	0.6607	0.6683	0.6759	0.6809	0.6860	(40)
HLP (average)												0.6778	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1348 (42)
Hot water usage for mixer showers

82.5173	81.2772	79.4702	76.0128	73.4613	70.6159	68.9985	70.7919	72.7577	75.8128	79.3445	82.2011	(42a)

Hot water usage for baths

25.9306	25.5455	25.0032	24.0033	23.2545	22.4243	21.9759	22.5144	23.1007	23.9891	25.0096	25.8429	(42b)

Hot water usage for other uses

36.4921	35.1651	33.8381	32.5112	31.1842	29.8572	29.8572	31.1842	32.5112	33.8381	35.1651	36.4921	(42c)

Average daily hot water use (litres/day) 133.2946 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.9400	141.9879	138.3115	132.5272	127.9000	122.8974	120.8316	124.4905	128.3696	133.6401	139.5193	144.5362	(44)
Energy conte	229.5496	202.1888	212.5797	181.4231	172.1780	151.1167	146.1353	154.1452	158.2926	181.3483	198.7708	226.3088	(45)
Energy content (annual)										Total = Sum(45)m =		2214.0368	
Distribution loss (46)m = 0.15 x (45)m	34.4324	30.3283	31.8870	27.2135	25.8267	22.6675	21.9203	23.1218	23.7439	27.2023	29.8156	33.9463	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
									Total per year (kWh/year) = Sum(64)m =		2461.0688	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

93.1099	82.3881	87.4674	76.5664	74.0338	66.4895	65.3746	68.0379	68.8755	77.0830	82.3345	92.0323	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.5047	19.1002	15.5334	11.7598	8.7906	7.4214	8.0190	10.4234	13.9903	17.7639	20.7331	22.1023	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	278.8333	281.7267	274.4354	258.9131	239.3189	220.9031	208.6002	205.7068	212.9981	228.5205	248.1147	266.5304	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(70)
Losses e.g. evaporation (negative values) (Table 5)	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	(71)
Water heating gains (Table 5)	125.1477	122.6013	117.5637	106.3422	99.5078	92.3465	87.8691	91.4488	95.6604	103.6061	114.3535	123.6993	(72)

Total internal gains

	518.1243	516.0669	500.1711	469.6536	440.2559	413.3096	397.1270	400.2177	415.2875	442.5292	475.8399	504.9707 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5900	10.6334	0.6300	0.8270	0.7700	13.7831	(74)
Northeast	7.1800	11.2829	0.6300	0.8270	0.7700	29.2500	(75)
Northwest	7.1800	11.2829	0.6300	0.8270	0.7700	29.2500	(81)

Solar gains	72.2831	145.4186	259.2999	424.2322	570.4595	608.5987	569.1396	453.3531	315.2363	176.8778	90.6113	59.2643	(83)
Total gains	590.4074	661.4856	759.4710	893.8859	1010.7154	1021.9082	966.2666	853.5708	730.5238	619.4070	566.4512	564.2350	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	77.5053	77.7874	78.0716	79.5242	79.8213	81.3404	81.3404	81.6511	80.7258	79.8213	79.2294	78.6462	
alpha	6.1670	6.1858	6.2048	6.3016	6.3214	6.4227	6.4227	6.4434	6.3817	6.3214	6.2820	6.2431	
util living area	0.9445	0.9007	0.7920	0.5923	0.4071	0.2724	0.1981	0.2336	0.4132	0.7111	0.8989	0.9536	(86)
MIT	20.5481	20.6983	20.8768	20.9801	20.9981	20.9999	21.0000	21.0000	20.9986	20.9543	20.7527	20.5181	(87)
Th 2	20.3443	20.3465	20.3488	20.3600	20.3622	20.3734	20.3734	20.3757	20.3689	20.3622	20.3577	20.3532	(88)
util rest of house	0.9348	0.8855	0.7677	0.5633	0.3795	0.2458	0.1699	0.2019	0.3758	0.6752	0.8811	0.9452	(89)
MIT 2	19.8330	20.0151	20.2220	20.3415	20.3607	20.3733	20.3734	20.3756	20.3680	20.3207	20.0932	19.8041	(90)
Living area fraction									fLA = Living area / (4) =			0.4663	(91)
MIT	20.1664	20.3337	20.5274	20.6393	20.6579	20.6655	20.6656	20.6668	20.6620	20.6162	20.4008	20.1371	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1664	20.3337	20.5274	20.6393	20.6579	20.6655	20.6656	20.6668	20.6620	20.6162	20.4008	20.1371	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9319	0.8852	0.7746	0.5761	0.3923	0.2582	0.1831	0.2167	0.3932	0.6898	0.8824	0.9421	(94)
Useful gains	550.2067	585.5253	588.2574	514.9257	396.5134	263.8737	176.8884	184.9303	287.2268	427.2788	499.8158	531.5653	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	724.4972	702.1815	635.8746	522.4329	397.1716	263.9064	176.8911	184.9379	287.6830	444.0905	594.1261	717.1646	(97)
Space heating kWh	129.6722	78.3929	35.4272	5.4052	0.4897	0.0000	0.0000	0.0000	0.0000	12.5079	67.9035	138.0859	(98a)
Space heating requirement - total per year (kWh/year)												467.8846	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	129.6722	78.3929	35.4272	5.4052	0.4897	0.0000	0.0000	0.0000	0.0000	12.5079	67.9035	138.0859	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												467.8846	
Space heating per m2										(98c) / (4) =		7.1324	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	129.6722	78.3929	35.4272	5.4052	0.4897	0.0000	0.0000	0.0000	0.0000	12.5079	67.9035	138.0859	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	129.6722	78.3929	35.4272	5.4052	0.4897	0.0000	0.0000	0.0000	0.0000	12.5079	67.9035	138.0859	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	12.1045	10.9331	12.1045	11.7141	12.1045	11.7141	12.1045	12.1045	11.7141	12.1045	11.7141	12.1045	(231)
Lighting	18.8229	15.1004	13.5963	9.9612	7.6943	6.2863	7.0190	9.1236	11.8506	15.5487	17.5622	19.3460	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.8109	-25.1338	-40.6028	-50.8141	-59.6203	-57.3843	-56.4723	-50.9617	-41.6122	-30.4670	-18.1973	-13.3238	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													

(233b)m	-2.9238	-6.9830	-15.9948	-27.1915	-38.1738	-39.2360	-38.6794	-31.3088	-21.3818	-11.1424	-4.2019	-2.2294	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	467.8846	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2461.0688	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	142.5210	(230a)
Total electricity for the above, kWh/year	142.5210	(231)
Electricity for lighting (calculated in Appendix L)	151.9116	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-699.8470	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2523.5390	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	467.8846	16.4900	77.1542	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	16.4900	405.8302	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	142.5210	16.4900	23.5017	(249)
Energy for lighting	151.9116	16.4900	25.0502	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.4004	16.4900	-75.9200	
PV Unit electricity exported	-239.4465	5.5900	-13.3851	
Total			-89.3051	(252)
Total energy cost			442.2312	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.4395	(257)
SAP value		76.6665	
SAP rating (Section 12)		77	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	467.8846	0.1590	74.3999	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2461.0688	0.1413	347.7259	(264)
Space and water heating			422.1258	(265)
Pumps, fans and electric keep-hot	142.5210	0.1387	19.7694	(267)
Energy for lighting	151.9116	0.1443	21.9255	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.4004	0.1324	-60.9491	
PV Unit electricity exported	-239.4465	0.1230	-29.4518	
Total			-90.4010	(269)
Total CO2, kg/year			373.4198	(272)
CO2 emissions per m2			5.6900	(273)
EI value			95.4757	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		65.6000 (1b)	x	2.4000 (2b)	=	157.4400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.6000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	157.4400	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			17.9500	1.2357	22.1816			(27)
External Wall 1	41.2300	17.9500	23.2800	0.1400	3.2592	14.0000	325.9200	(29a)
Total net area of external elements Aum(A, m2)			41.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.4408			(33)
Party Wall 1			30.2400	0.0000	0.0000	20.0000	604.8000	(32)
Wall to corridor			14.1800	0.0000	0.0000	20.0000	283.6000	(32)
Party Floor 1			65.6000			80.0000	5248.0000	(32d)
Party Ceiling 1			65.6000			80.0000	5248.0000	(32b)
Internal Wall 1			114.4800			9.0000	1030.3200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12740.6400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		194.2171 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	7.8800	0.0500	0.3940
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	30.5400	0.0700	2.1378
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	32.9000	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.5018 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	29.9426 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.8853	15.8853	15.5541	14.5604	14.3948	13.7324	13.4012	13.4012	14.0636	14.8917	15.2229	15.0573	(38)
Heat transfer coeff	45.8279	45.8279	45.4966	44.5030	44.3374	43.6750	43.3438	43.3438	44.0062	44.8342	45.1654	44.9998	(39)
Average = Sum(39)m / 12 =												44.6134	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6986	0.6986	0.6935	0.6784	0.6759	0.6658	0.6607	0.6607	0.6708	0.6834	0.6885	0.6860	(40)
HLP (average)												0.6801	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1348	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	82.5173	81.2772	79.4702	76.0128	73.4613	70.6159	68.9985	70.7919	72.7577	75.8128	79.3445	82.2011	(42a)
Hot water usage for baths	25.9306	25.5455	25.0032	24.0033	23.2545	22.4243	21.9759	22.5144	23.1007	23.9891	25.0096	25.8429	(42b)
Hot water usage for other uses	36.4921	35.1651	33.8381	32.5112	31.1842	29.8572	29.8572	31.1842	32.5112	33.8381	35.1651	36.4921	(42c)
Average daily hot water use (litres/day)												133.2946	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.9400	141.9879	138.3115	132.5272	127.9000	122.8974	120.8316	124.4905	128.3696	133.6401	139.5193	144.5362	(44)
Energy conte	229.5496	202.1888	212.5797	181.4231	172.1780	151.1167	146.1353	154.1452	158.2926	181.3483	198.7708	226.3088	(45)
Energy content (annual)										Total = Sum(45)m =		2214.0368	
Distribution loss (46)m = 0.15 x (45)m	34.4324	30.3283	31.8870	27.2135	25.8267	22.6675	21.9203	23.1218	23.7439	27.2023	29.8156	33.9463	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)

Total per year (kWh/year) = Sum(64)m = 2461.0688 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

93.1099	82.3881	87.4674	76.5664	74.0338	66.4895	65.3746	68.0379	68.8755	77.0830	82.3345	92.0323	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

21.5047	19.1002	15.5334	11.7598	8.7906	7.4214	8.0190	10.4234	13.9903	17.7639	20.7331	22.1023	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

278.8333	281.7267	274.4354	258.9131	239.3189	220.9031	208.6002	205.7068	212.9981	228.5205	248.1147	266.5304	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	(71)

Water heating gains (Table 5)

125.1477	122.6013	117.5637	106.3422	99.5078	92.3465	87.8691	91.4488	95.6604	103.6061	114.3535	123.6993	(72)

Total internal gains

518.1243	516.0669	500.1711	469.6536	440.2559	413.3096	397.1270	400.2177	415.2875	442.5292	475.8399	504.9707	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5900	9.5462	0.6300	0.8270	0.7700	12.3738	(74)
Northeast	7.1800	10.0309	0.6300	0.8270	0.7700	26.0043	(75)
Northwest	7.1800	10.0309	0.6300	0.8270	0.7700	26.0043	(81)

Solar gains 64.3824	137.7004	255.9710	441.5733	590.5612	614.0120	580.6227	447.7696	308.5106	166.2493	82.8380	54.0541	(83)
Total gains 582.5066	653.7673	756.1421	911.2269	1030.8171	1027.3216	977.7498	847.9874	723.7981	608.7785	558.6779	559.0248	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	77.2252	77.2252	77.7874	79.5242	79.8213	81.0319	81.6511	81.6511	80.4220	78.9367	78.3579	78.6462	
alpha	6.1483	6.1483	6.1858	6.3016	6.3214	6.4021	6.4434	6.4434	6.3615	6.2624	6.2239	6.2431	
util living area													
	0.9529	0.9181	0.8260	0.6254	0.4416	0.3314	0.2704	0.3168	0.4955	0.7722	0.9178	0.9608	(86)
MIT	20.4962	20.6361	20.8321	20.9710	20.9967	20.9996	20.9999	20.9998	20.9952	20.9192	20.6960	20.4663	(87)
Th 2	20.3421	20.3421	20.3465	20.3600	20.3622	20.3712	20.3757	20.3757	20.3667	20.3555	20.3510	20.3532	(88)
util rest of house													
	0.9446	0.9052	0.8045	0.5978	0.4146	0.3048	0.2427	0.2849	0.4583	0.7400	0.9028	0.9537	(89)
MIT 2	19.7671	19.9366	20.1693	20.3322	20.3594	20.3709	20.3756	20.3755	20.3630	20.2782	20.0201	19.7397	(90)
Living area fraction									fLA = Living area / (4) =			0.4663	(91)
MIT	20.1071	20.2628	20.4784	20.6301	20.6566	20.6640	20.6667	20.6666	20.6578	20.5771	20.3352	20.0785	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1071	20.2628	20.4784	20.6301	20.6566	20.6640	20.6667	20.6666	20.6578	20.5771	20.3352	20.0785	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9412	0.9035	0.8090	0.6096	0.4271	0.3172	0.2556	0.2998	0.4755	0.7514	0.9024	0.9503	(94)
Useful gains	548.2738	590.7065	611.7196	555.4598	440.2617	325.8480	249.9229	254.2044	344.1401	457.4466	504.1336	531.2360	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	742.7367	731.5405	676.9151	566.5280	441.4496	325.9912	249.9512	254.2803	345.7913	487.6664	620.3584	737.0302	(97)
Space heating kWh													
	144.6804	94.6405	48.5055	7.9691	0.8838	0.0000	0.0000	0.0000	0.0000	22.4835	83.6818	153.1109	(98a)
Space heating requirement - total per year (kWh/year)												555.9554	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	144.6804	94.6405	48.5055	7.9691	0.8838	0.0000	0.0000	0.0000	0.0000	22.4835	83.6818	153.1109	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												555.9554	
Space heating per m2											(98c) / (4) =	8.4749	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	144.6804	94.6405	48.5055	7.9691	0.8838	0.0000	0.0000	0.0000	0.0000	22.4835	83.6818	153.1109	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	144.6804	94.6405	48.5055	7.9691	0.8838	0.0000	0.0000	0.0000	0.0000	22.4835	83.6818	153.1109	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	12.1045	10.9331	12.1045	11.7141	12.1045	11.7141	12.1045	12.1045	11.7141	12.1045	11.7141	12.1045	(231)
Lighting	18.8229	15.1004	13.5963	9.9612	7.6943	6.2863	7.0190	9.1236	11.8506	15.5487	17.5622	19.3460	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.3294	-24.2494	-40.7630	-53.0343	-61.7357	-58.2186	-57.7804	-50.9772	-41.3377	-29.2864	-16.9529	-12.3202	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4617	-6.4520	-15.8152	-29.2384	-40.7154	-40.3248	-40.3981	-31.3264	-21.1298	-10.2503	-3.6730	-1.9401	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	555.9554	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2461.0688	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	142.5210	(230a)
Total electricity for the above, kWh/year	142.5210	(231)
Electricity for lighting (calculated in Appendix L)	151.9116	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-704.7104	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2606.7464	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	555.9554	25.1600	139.8784	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	25.1600	619.2049	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	142.5210	25.1600	35.8583	(249)
Energy for lighting	151.9116	25.1600	38.2210	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.9852	25.1600	-115.9839	
PV Unit electricity exported	-243.7252	5.8100	-14.1604	
Total			-130.1443	(252)
Total energy cost			703.0182	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	555.9554	0.1584	88.0537	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2461.0688	0.1413	347.7259	(264)
Space and water heating			435.7797	(265)
Pumps, fans and electric keep-hot	142.5210	0.1387	19.7694	(267)
Energy for lighting	151.9116	0.1443	21.9255	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.9852	0.1321	-60.8889	
PV Unit electricity exported	-243.7252	0.1225	-29.8480	
Total			-90.7368	(269)
Total CO2, kg/year			386.7378	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	555.9554	1.5863	881.8850	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	1.5225	3746.8812	(278)
Space and water heating			4628.7662	(279)
Pumps, fans and electric keep-hot	142.5210	1.5128	215.6057	(281)
Energy for lighting	151.9116	1.5338	233.0071	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.9852	1.4880	-685.9583	
PV Unit electricity exported	-243.7252	0.4494	-109.5387	
Total			-795.4970	(283)
Total Primary energy kWh/year			4281.8820	(286)

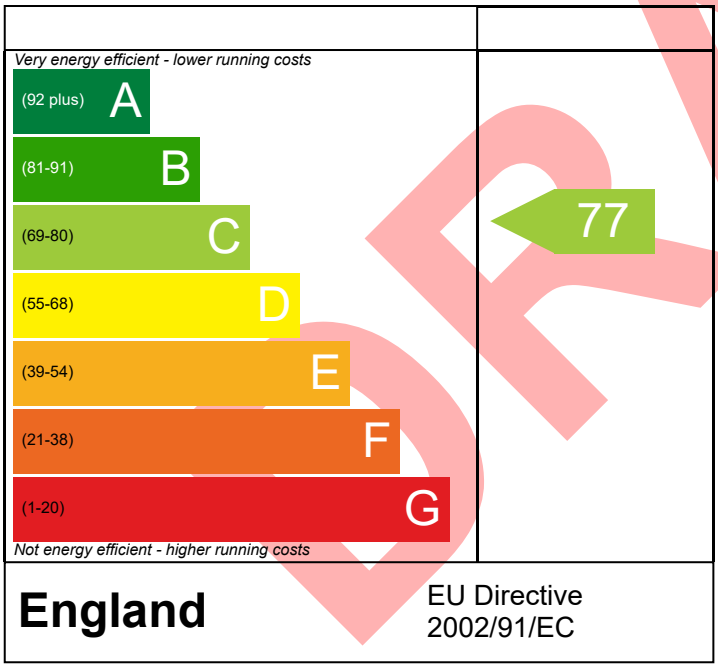
Predicted Energy Assessment

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	65.6 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

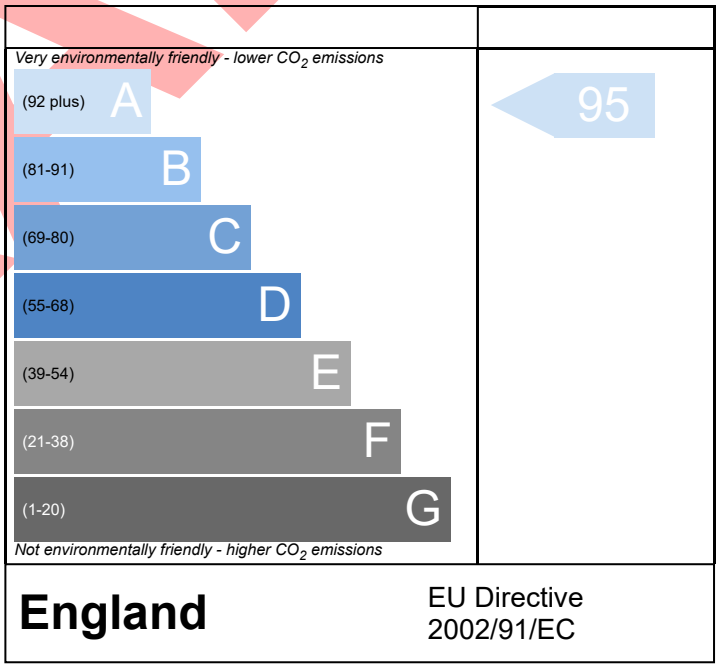
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:22

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	71 m^2
Site Reference	Unit 126 L06_Copy	Plot Reference	Unit 126 L06_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*10.28 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	4.62 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*55.55 kWh$_{PE}$/m^2*	
Dwelling primary energy	52.32 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*17.7 kWh/m^2*	
Dwelling fabric energy efficiency	16.7 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	12.04	0.14 **(!)**
Party wall: Party Wall (1)	52.62	0 **(!)**
Party wall: Party Wall (2)	15.55	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	10.77	North East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.92 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 126 L06_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 126 L06_Copy	**Prop Type Ref**	Unit 126 L06
Property			

SAP Rating	80 C	**DER**	4.62	**TER**	10.28
Environmental	96 A	**% DER < TER**			55.06
CO_2 Emissions (t/year)	0.33	**DFEE**	16.69	**TFEE**	17.69
Compliance Check	See BREL	**% DFEE < TFEE**			5.66
% DPER < TPER	5.81	**DPER**	52.32	**TPER**	55.55

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.7700	1.2357	13.3089			(27)
External Wall 1	22.8100	10.7700	12.0400	0.1400	1.6856	14.0000	168.5600	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.9945			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 14125.6300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	199.0086	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	4.6400	0.0500	0.2320

E4 Jamb	13.9200	0.0500	0.6960	
E7 Party floor between dwellings (in blocks of flats)	16.9000	0.0700	1.1830	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	0.0000	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.4350 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 17.4295 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.2026	16.0392	15.8758	15.0589	14.8955	14.0786	14.0786	13.9153	14.4054	14.8955	15.2223	15.5490	(38)
Heat transfer coeff	33.6321	33.4687	33.3053	32.4884	32.3251	31.5082	31.5082	31.3448	31.8349	32.3251	32.6518	32.9786	(39)

Average = Sum(39)m / 12 = 32.4476

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4738	0.4715	0.4692	0.4577	0.4554	0.4439	0.4439	0.4416	0.4485	0.4554	0.4600	0.4646	(40)
HLP (average)												0.4571	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2697 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day) 138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)

Energy content (annual) Total = Sum(45)m = 2297.5146

Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)

Total per year (kWh/year) = Sum(64)m = 2544.5466 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.4790	20.8538	16.9595	12.8394	9.5976	8.1027	8.7553	11.3804	15.2748	19.3948	22.6366	24.1315	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.6468	544.4702	527.5591	495.2123	463.9464	435.3471	418.2106	421.4595	437.5134	466.4610	501.7873	532.6536	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.7700	11.2829	0.6300	0.8270	0.7700	43.8750	(75)

Solar gains	43.8750	89.3089	160.9062	264.2542	355.2095	378.6909	354.2576	282.4182	196.0667	109.1425	55.2061	35.8305	(83)
Total gains	590.5219	633.7791	688.4652	759.4665	819.1559	814.0379	772.4682	703.8778	633.5801	575.6035	556.9934	568.4842	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	116.6679	117.2375	117.8126	120.7748	121.3853	124.5323	124.5323	125.1814	123.2541	121.3853	120.1705	118.9799	
alpha	8.7779	8.8158	8.8542	9.0517	9.0924	9.3022	9.3022	9.3454	9.2169	9.0924	9.0114	8.9320	
util living area													
	0.8738	0.8120	0.6921	0.5170	0.3670	0.2477	0.1795	0.2048	0.3467	0.5822	0.7875	0.8874	(86)
MIT	20.9037	20.9488	20.9864	20.9990	21.0000	21.0000	21.0000	21.0000	21.0000	20.9978	20.9677	20.8951	(87)
Th 2	20.5449	20.5470	20.5491	20.5597	20.5619	20.5725	20.5725	20.5747	20.5683	20.5619	20.5576	20.5534	(88)
util rest of house													
	0.8595	0.7947	0.6724	0.4983	0.3497	0.2312	0.1620	0.1859	0.3250	0.5582	0.7672	0.8740	(89)
MIT 2	20.4398	20.4928	20.5355	20.5588	20.5618	20.5725	20.5725	20.5747	20.5682	20.5599	20.5248	20.4382	(90)
Living area fraction										fLA = Living area / (4) =		0.4060	(91)
MIT	20.6282	20.6780	20.7186	20.7375	20.7397	20.7461	20.7461	20.7474	20.7435	20.7377	20.7046	20.6237	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6282	20.6780	20.7186	20.7375	20.7397	20.7461	20.7461	20.7474	20.7435	20.7377	20.7046	20.6237	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8622	0.7998	0.6798	0.5059	0.3567	0.2379	0.1691	0.1936	0.3338	0.5679	0.7741	0.8762	(94)
Useful gains	509.1552	506.9108	468.0359	384.1807	292.1937	193.6518	130.6357	136.2669	211.4910	326.8566	431.1499	498.1109	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	549.1502	528.0687	473.5548	384.5824	292.2097	193.6520	130.6357	136.2669	211.4967	327.7013	444.2164	541.6302	(97)
Space heating kWh													
	29.7562	14.2181	4.1060	0.2892	0.0119	0.0000	0.0000	0.0000	0.0000	0.6285	9.4079	32.3784	(98a)
Space heating requirement - total per year (kWh/year)												90.7963	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	29.7562	14.2181	4.1060	0.2892	0.0119	0.0000	0.0000	0.0000	0.0000	0.6285	9.4079	32.3784	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												90.7963	
Space heating per m2											(98c) / (4) =	1.2792	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	29.7562	14.2181	4.1060	0.2892	0.0119	0.0000	0.0000	0.0000	0.0000	0.6285	9.4079	32.3784	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	29.7562	14.2181	4.1060	0.2892	0.0119	0.0000	0.0000	0.0000	0.0000	0.6285	9.4079	32.3784	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)
Lighting	20.5510	16.4868	14.8445	10.8757	8.4007	6.8635	7.6634	9.9612	12.9386	16.9762	19.1746	21.1222	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.7984	-26.6422	-43.2464	-54.4982	-64.0245	-61.6137	-60.6333	-54.7508	-44.7534	-32.6700	-19.3681	-14.1637	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.4791	-8.1195	-18.0123	-29.9314	-41.8232	-42.9635	-42.3544	-34.2949	-23.4284	-12.3660	-4.8757	-2.6704	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	90.7963	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2544.5466	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	154.2094	(230a)
Total electricity for the above, kWh/year	154.2094	(231)
Electricity for lighting (calculated in Appendix L)	165.8585	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-757.4814	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2197.9294	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	90.7963	16.4900	14.9723	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	16.4900	419.5957	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	16.4900	25.4291	(249)
Energy for lighting	165.8585	16.4900	27.3501	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.1626	16.4900	-81.3225	
PV Unit electricity exported	-264.3188	5.5900	-14.7754	
Total			-96.0979	(252)
Total energy cost			391.2493	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2144	(257)
SAP value		80.3141	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	90.7963	0.1606	14.5801	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			374.1246	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	165.8585	0.1443	23.9385	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.1626	0.1323	-65.2544	
PV Unit electricity exported	-264.3188	0.1234	-32.6253	
Total			-97.8797	(269)
Total CO2, kg/year			321.5742	(272)
CO2 emissions per m2			4.5300	(273)
EI value			96.2846	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.7700	1.2357	13.3089			(27)
External Wall 1	22.8100	10.7700	12.0400	0.1400	1.6856	14.0000	168.5600	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.9945			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14125.6300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 199.0086 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	4.6400	0.0500	0.2320
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	16.9000	0.0700	1.1830
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	0.0000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.4350 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 17.4295 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3659	16.3659	16.0392	15.0589	14.8955	14.2420	13.9153	13.9153	14.5688	15.3857	15.7124	15.5490	(38)
Heat transfer coeff	33.7955	33.7955	33.4687	32.4884	32.3251	31.6715	31.3448	31.3448	31.9983	32.8152	33.1420	32.9786	(39)
Average = Sum(39)m / 12 =												32.5974	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4761	0.4761	0.4715	0.4577	0.4554	0.4462	0.4416	0.4416	0.4508	0.4623	0.4669	0.4646	(40)
HLP (average)												0.4592	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2697 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)
Average daily hot water use (litres/day)												138.3203	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
									Total per year (kWh/year) = Sum(64)m =			2544.5466	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.4790	20.8538	16.9595	12.8394	9.5976	8.1027	8.7553	11.3804	15.2748	19.3948	22.6366	24.1315	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)													
	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains													
	546.6468	544.4702	527.5591	495.2123	463.9464	435.3471	418.2106	421.4595	437.5134	466.4610	501.7873	532.6536	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.7700	10.0309	0.6300	0.8270	0.7700	39.0064	(75)

Solar gains	39.0064	84.4476	158.7276	275.0250	367.7778	382.1355	361.4694	278.9456	191.8002	102.4648	50.3815	32.6165	(83)
Total gains	585.6532	628.9178	686.2866	770.2373	831.7242	817.4825	779.6800	700.4051	629.3136	568.9258	552.1688	565.2701	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	116.1039	116.1039	117.2375	120.7748	121.3853	123.8899	125.1814	125.1814	122.6248	119.5722	118.3933	118.9799	
alpha	8.7403	8.7403	8.8158	9.0517	9.0924	9.2593	9.3454	9.3454	9.1750	8.9715	8.8929	8.9320	
util living area													
	0.8913	0.8425	0.7351	0.5514	0.4003	0.3022	0.2452	0.2775	0.4169	0.6468	0.8223	0.9034	(86)
MIT	20.8820	20.9272	20.9769	20.9981	20.9999	21.0000	21.0000	21.0000	20.9999	20.9940	20.9510	20.8734	(87)
Th 2	20.5428	20.5428	20.5470	20.5597	20.5619	20.5704	20.5747	20.5747	20.5661	20.5555	20.5512	20.5534	(88)
util rest of house													
	0.8783	0.8268	0.7162	0.5331	0.3832	0.2855	0.2281	0.2584	0.3948	0.6226	0.8034	0.8916	(89)
MIT 2	20.4126	20.4644	20.5233	20.5580	20.5618	20.5704	20.5747	20.5746	20.5660	20.5500	20.5004	20.4127	(90)
Living area fraction										fLA = Living area / (4) =		0.4060	(91)
MIT	20.6032	20.6523	20.7075	20.7367	20.7397	20.7448	20.7474	20.7474	20.7422	20.7303	20.6833	20.5997	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6032	20.6523	20.7075	20.7367	20.7397	20.7448	20.7474	20.7474	20.7422	20.7303	20.6833	20.5997	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8801	0.8306	0.7229	0.5405	0.3901	0.2923	0.2351	0.2662	0.4038	0.6322	0.8091	0.8928	(94)
Useful gains	515.4081	522.4049	496.1490	416.3011	324.4950	238.9542	183.2839	186.4180	254.1001	359.6583	446.7591	504.6933	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	564.4927	552.6341	505.6279	417.0436	324.5330	238.9561	183.2841	186.4186	254.1370	361.9617	466.7492	557.3293	(97)
Space heating kWh													
	36.5190	20.3140	7.0523	0.5346	0.0283	0.0000	0.0000	0.0000	0.0000	1.7137	14.3929	39.1611	(98a)
Space heating requirement - total per year (kWh/year)												119.7160	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	36.5190	20.3140	7.0523	0.5346	0.0283	0.0000	0.0000	0.0000	0.0000	1.7137	14.3929	39.1611	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												119.7160	
Space heating per m2											(98c) / (4) =	1.6866	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	36.5190	20.3140	7.0523	0.5346	0.0283	0.0000	0.0000	0.0000	0.0000	1.7137	14.3929	39.1611	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	36.5190	20.3140	7.0523	0.5346	0.0283	0.0000	0.0000	0.0000	0.0000	1.7137	14.3929	39.1611	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)

Lighting	20.5510	16.4868	14.8445	10.8757	8.4007	6.8635	7.6634	9.9612	12.9386	16.9762	19.1746	21.1222 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-15.2273	-25.6649	-43.2785	-56.7966	-66.2677	-62.5045	-62.0296	-54.7674	-44.4594	-31.3128	-18.0214	-13.0974 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.9466	-7.5648	-17.9591	-32.2515	-44.6206	-44.1543	-44.2341	-34.3141	-23.1526	-11.4798	-4.3030	-2.3373 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	119.7160 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2544.5466 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	154.2094 (230a)
Total electricity for the above, kWh/year	154.2094 (231)
Electricity for lighting (calculated in Appendix L)	165.8585 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-762.7453 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2221.5852 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	119.7160	25.1600	30.1205	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	25.1600	640.2079	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	25.1600	38.7991	(249)
Energy for lighting	165.8585	25.1600	41.7300	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.4275	25.1600	-124.1464	
PV Unit electricity exported	-269.3178	5.8100	-15.6474	
Total			-139.7937	(252)
Total energy cost			611.0638	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	119.7160	0.1600	19.1517	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			378.6963	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	165.8585	0.1443	23.9385	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.4275	0.1320	-65.1378	
PV Unit electricity exported	-269.3178	0.1229	-33.1080	
Total			-98.2458	(269)
Total CO2, kg/year			325.7798	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	119.7160	1.5921	190.5977	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	1.5225	3874.0629	(278)
Space and water heating			4064.6606	(279)
Pumps, fans and electric keep-hot	154.2094	1.5128	233.2880	(281)
Energy for lighting	165.8585	1.5338	254.3994	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.4275	1.4877	-734.0966	
PV Unit electricity exported	-269.3178	0.4512	-121.5061	
Total			-855.6027	(283)
Total Primary energy kWh/year			3696.7453	(286)

SAP 10 EPC IMPROVEMENTS

Unit 126 L06_Copy

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 80
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£751	£751	£0
Space heating	£69	£69	£0
Water heating	£640	£640	£0
Lighting	£42	£42	£0
Generated (PV)	-£140	-£140	£0
Total cost of fuels	£611	£611	£0
Total cost of uses	£611	£611	£0
Delivered energy	31 kWh/m²	31 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	52 kWh/m²	52 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.7700	1.2357	13.3089			(27)
External Wall 1	22.8100	10.7700	12.0400	0.1400	1.6856	14.0000	168.5600	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.9945			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14125.6300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		199.0086 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	4.6400	0.0500	0.2320
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	16.9000	0.0700	1.1830
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	0.0000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		2.4350 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	17.4295 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.2026	16.0392	15.8758	15.0589	14.8955	14.0786	14.0786	13.9153	14.4054	14.8955	15.2223	15.5490	(38)
Heat transfer coeff	33.6321	33.4687	33.3053	32.4884	32.3251	31.5082	31.5082	31.3448	31.8349	32.3251	32.6518	32.9786	(39)
Average = Sum(39)m / 12 =												32.4476	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4738	0.4715	0.4692	0.4577	0.4554	0.4439	0.4439	0.4416	0.4485	0.4554	0.4600	0.4646	(40)
HLP (average)												0.4571	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.2697 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)

Hot water usage for baths

26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)

Hot water usage for other uses

37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day)		138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m													
	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
									Total per year (kWh/year) = Sum(64)m =		2544.5466	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.4790	20.8538	16.9595	12.8394	9.5976	8.1027	8.7553	11.3804	15.2748	19.3948	22.6366	24.1315	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.6468	544.4702	527.5591	495.2123	463.9464	435.3471	418.2106	421.4595	437.5134	466.4610	501.7873	532.6536	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.7700	11.2829	0.6300	0.8270	0.7700	43.8750	(75)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	43.8750	89.3089	160.9062	264.2542	355.2095	378.6909	354.2576	282.4182	196.0667	109.1425	55.2061	35.8305	(83)
Total gains	590.5219	633.7791	688.4652	759.4665	819.1559	814.0379	772.4682	703.8778	633.5801	575.6035	556.9934	568.4842	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	116.6679	117.2375	117.8126	120.7748	121.3853	124.5323	124.5323	125.1814	123.2541	121.3853	120.1705	118.9799	
alpha	8.7779	8.8158	8.8542	9.0517	9.0924	9.3022	9.3022	9.3454	9.2169	9.0924	9.0114	8.9320	
util living area	0.8738	0.8120	0.6921	0.5170	0.3670	0.2477	0.1795	0.2048	0.3467	0.5822	0.7875	0.8874	(86)
MIT	20.9037	20.9488	20.9864	20.9990	21.0000	21.0000	21.0000	21.0000	21.0000	20.9978	20.9677	20.8951	(87)
Th 2	20.5449	20.5470	20.5491	20.5597	20.5619	20.5725	20.5725	20.5747	20.5683	20.5619	20.5576	20.5534	(88)
util rest of house	0.8595	0.7947	0.6724	0.4983	0.3497	0.2312	0.1620	0.1859	0.3250	0.5582	0.7672	0.8740	(89)
MIT 2	20.4398	20.4928	20.5355	20.5588	20.5618	20.5725	20.5725	20.5747	20.5682	20.5599	20.5248	20.4382	(90)
Living area fraction									fLA = Living area / (4) =			0.4060	(91)
MIT	20.6282	20.6780	20.7186	20.7375	20.7397	20.7461	20.7461	20.7474	20.7435	20.7377	20.7046	20.6237	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6282	20.6780	20.7186	20.7375	20.7397	20.7461	20.7461	20.7474	20.7435	20.7377	20.7046	20.6237	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8622	0.7998	0.6798	0.5059	0.3567	0.2379	0.1691	0.1936	0.3338	0.5679	0.7741	0.8762	(94)
Useful gains	509.1552	506.9108	468.0359	384.1807	292.1937	193.6518	130.6357	136.2669	211.4910	326.8566	431.1499	498.1109	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	549.1502	528.0687	473.5548	384.5824	292.2097	193.6520	130.6357	136.2669	211.4967	327.7013	444.2164	541.6302	(97)
Space heating kWh	29.7562	14.2181	4.1060	0.2892	0.0119	0.0000	0.0000	0.0000	0.0000	0.6285	9.4079	32.3784	(98a)
Space heating requirement - total per year (kWh/year)												90.7963	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	29.7562	14.2181	4.1060	0.2892	0.0119	0.0000	0.0000	0.0000	0.0000	0.6285	9.4079	32.3784	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												90.7963	
Space heating per m2										(98c) / (4) =		1.2792	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	29.7562	14.2181	4.1060	0.2892	0.0119	0.0000	0.0000	0.0000	0.0000	0.6285	9.4079	32.3784	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	29.7562	14.2181	4.1060	0.2892	0.0119	0.0000	0.0000	0.0000	0.0000	0.6285	9.4079	32.3784	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)
Lighting	20.5510	16.4868	14.8445	10.8757	8.4007	6.8635	7.6634	9.9612	12.9386	16.9762	19.1746	21.1222	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.7984	-26.6422	-43.2464	-54.4982	-64.0245	-61.6137	-60.6333	-54.7508	-44.7534	-32.6700	-19.3681	-14.1637	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.4791	-8.1195	-18.0123	-29.9314	-41.8232	-42.9635	-42.3544	-34.2949	-23.4284	-12.3660	-4.8757	-2.6704	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												90.7963	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2544.5466	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	154.2094	(230a)
Total electricity for the above, kWh/year	154.2094	(231)
Electricity for lighting (calculated in Appendix L)	165.8585	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-757.4814	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2197.9294	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	90.7963	16.4900	14.9723	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	16.4900	419.5957	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	16.4900	25.4291	(249)
Energy for lighting	165.8585	16.4900	27.3501	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.1626	16.4900	-81.3225	
PV Unit electricity exported	-264.3188	5.5900	-14.7754	
Total			-96.0979	(252)
Total energy cost			391.2493	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2144	(257)
SAP value		80.3141	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	90.7963	0.1606	14.5801	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			374.1246	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	165.8585	0.1443	23.9385	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.1626	0.1323	-65.2544	
PV Unit electricity exported	-264.3188	0.1234	-32.6253	
Total			-97.8797	(269)
Total CO2, kg/year			321.5742	(272)
CO2 emissions per m2			4.5300	(273)
EI value			96.2846	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.7700	1.2357	13.3089			(27)
External Wall 1	22.8100	10.7700	12.0400	0.1400	1.6856	14.0000	168.5600	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	14.9945			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14125.6300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		199.0086 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	4.6400	0.0500	0.2320
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	16.9000	0.0700	1.1830
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	0.0000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		2.4350 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	17.4295 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3659	16.3659	16.0392	15.0589	14.8955	14.2420	13.9153	13.9153	14.5688	15.3857	15.7124	15.5490	(38)
Heat transfer coeff	33.7955	33.7955	33.4687	32.4884	32.3251	31.6715	31.3448	31.3448	31.9983	32.8152	33.1420	32.9786	(39)
Average = Sum(39)m / 12 =												32.5974	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4761	0.4761	0.4715	0.4577	0.4554	0.4462	0.4416	0.4416	0.4508	0.4623	0.4669	0.4646	(40)
HLP (average)												0.4592	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.2697 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)
Average daily hot water use (litres/day)												138.3203	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
									Total per year (kWh/year) = Sum(64)m =			2544.5466	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.4790	20.8538	16.9595	12.8394	9.5976	8.1027	8.7553	11.3804	15.2748	19.3948	22.6366	24.1315	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.6468	544.4702	527.5591	495.2123	463.9464	435.3471	418.2106	421.4595	437.5134	466.4610	501.7873	532.6536	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.7700	10.0309	0.6300	0.8270	0.7700	39.0064	(75)

Solar gains	39.0064	84.4476	158.7276	275.0250	367.7778	382.1355	361.4694	278.9456	191.8002	102.4648	50.3815	32.6165	(83)
Total gains	585.6532	628.9178	686.2866	770.2373	831.7242	817.4825	779.6800	700.4051	629.3136	568.9258	552.1688	565.2701	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	116.1039	116.1039	117.2375	120.7748	121.3853	123.8899	125.1814	125.1814	122.6248	119.5722	118.3933	118.9799	
alpha	8.7403	8.7403	8.8158	9.0517	9.0924	9.2593	9.3454	9.3454	9.1750	8.9715	8.8929	8.9320	
util living area	0.8913	0.8425	0.7351	0.5514	0.4003	0.3022	0.2452	0.2775	0.4169	0.6468	0.8223	0.9034	(86)
MIT	20.8820	20.9272	20.9769	20.9981	20.9999	21.0000	21.0000	21.0000	20.9999	20.9940	20.9510	20.8734	(87)
Th 2	20.5428	20.5428	20.5470	20.5597	20.5619	20.5704	20.5747	20.5747	20.5661	20.5555	20.5512	20.5534	(88)
util rest of house	0.8783	0.8268	0.7162	0.5331	0.3832	0.2855	0.2281	0.2584	0.3948	0.6226	0.8034	0.8916	(89)
MIT 2	20.4126	20.4644	20.5233	20.5580	20.5618	20.5704	20.5747	20.5746	20.5660	20.5500	20.5004	20.4127	(90)
Living area fraction										fLA = Living area / (4) =		0.4060	(91)
MIT	20.6032	20.6523	20.7075	20.7367	20.7397	20.7448	20.7474	20.7474	20.7422	20.7303	20.6833	20.5997	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6032	20.6523	20.7075	20.7367	20.7397	20.7448	20.7474	20.7474	20.7422	20.7303	20.6833	20.5997	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8801	0.8306	0.7229	0.5405	0.3901	0.2923	0.2351	0.2662	0.4038	0.6322	0.8091	0.8928	(94)
Useful gains	515.4081	522.4049	496.1490	416.3011	324.4950	238.9542	183.2839	186.4180	254.1001	359.6583	446.7591	504.6933	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	564.4927	552.6341	505.6279	417.0436	324.5330	238.9561	183.2841	186.4186	254.1370	361.9617	466.7492	557.3293	(97)
Space heating kWh	36.5190	20.3140	7.0523	0.5346	0.0283	0.0000	0.0000	0.0000	0.0000	1.7137	14.3929	39.1611	(98a)
Space heating requirement - total per year (kWh/year)												119.7160	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	36.5190	20.3140	7.0523	0.5346	0.0283	0.0000	0.0000	0.0000	0.0000	1.7137	14.3929	39.1611	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												119.7160	
Space heating per m2											(98c) / (4) =	1.6866	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	36.5190	20.3140	7.0523	0.5346	0.0283	0.0000	0.0000	0.0000	0.0000	1.7137	14.3929	39.1611	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													

	36.5190	20.3140	7.0523	0.5346	0.0283	0.0000	0.0000	0.0000	0.0000	1.7137	14.3929	39.1611 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating

Water heating requirement												
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972 (231)
Lighting	20.5510	16.4868	14.8445	10.8757	8.4007	6.8635	7.6634	9.9612	12.9386	16.9762	19.1746	21.1222 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-15.2273	-25.6649	-43.2785	-56.7966	-66.2677	-62.5045	-62.0296	-54.7674	-44.4594	-31.3128	-18.0214	-13.0974 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.9466	-7.5648	-17.9591	-32.2515	-44.6206	-44.1543	-44.2341	-34.3141	-23.1526	-11.4798	-4.3030	-2.3373 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	119.7160 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2544.5466 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	154.2094 (230a)
Total electricity for the above, kWh/year	154.2094 (231)
Electricity for lighting (calculated in Appendix L)	165.8585 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-762.7453 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2221.5852 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	119.7160	25.1600	30.1205	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	25.1600	640.2079	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	25.1600	38.7991	(249)
Energy for lighting	165.8585	25.1600	41.7300	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.4275	25.1600	-124.1464	
PV Unit electricity exported	-269.3178	5.8100	-15.6474	
Total			-139.7937	(252)
Total energy cost			611.0638	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	119.7160	0.1600	19.1517	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			378.6963	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	165.8585	0.1443	23.9385	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.4275	0.1320	-65.1378	
PV Unit electricity exported	-269.3178	0.1229	-33.1080	
Total			-98.2458	(269)
Total CO2, kg/year			325.7798	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	119.7160	1.5921	190.5977	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	1.5225	3874.0629	(278)
Space and water heating			4064.6606	(279)

Pumps, fans and electric keep-hot	154.2094	1.5128	233.2880 (281)
Energy for lighting	165.8585	1.5338	254.3994 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-493.4275	1.4877	-734.0966
PV Unit electricity exported	-269.3178	0.4512	-121.5061
Total			-855.6027 (283)
Total Primary energy kWh/year			3696.7453 (286)

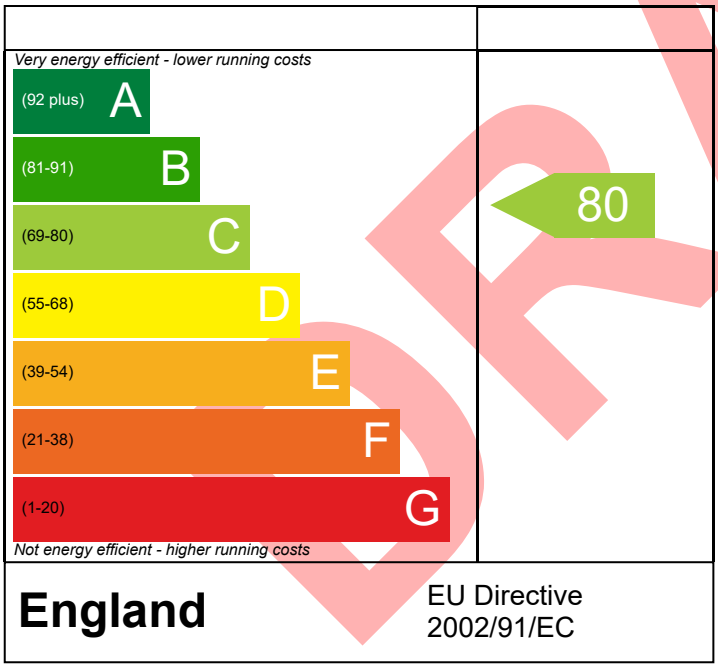
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	70.98 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

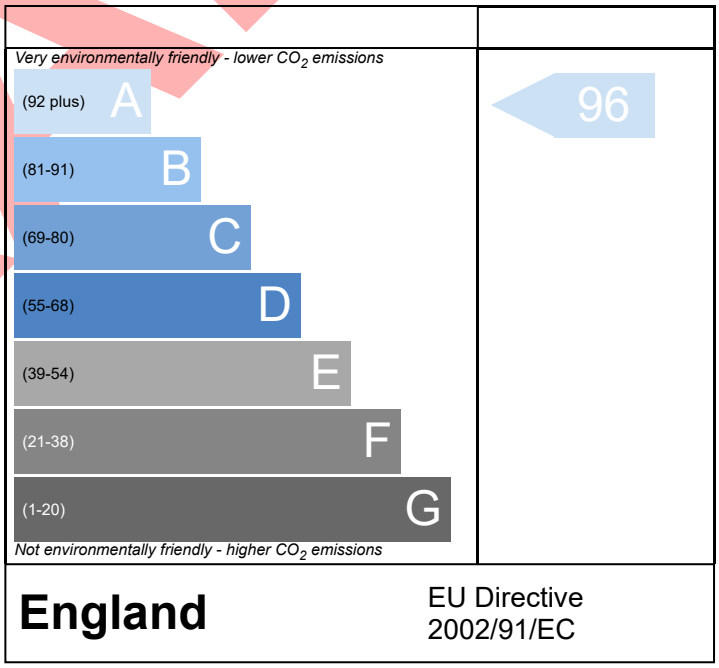
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:22

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	66 m^2
Site Reference	Unit 127 L06_Copy	Plot Reference	Unit 127 L06_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.48 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	5.43 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*62.01 kWh$_{PE}$/m^2*	
Dwelling primary energy	60.47 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*23.0 kWh/m^2*	
Dwelling fabric energy efficiency	22.2 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	26.86	0.14 **(!)**
Party wall: Party Wall (1)	55.02	0 **(!)**
Party wall: Party Wall (2)	3.85	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SE, Opening Type 1	10.77	South East	0.83	1.3
NE, Opening Type 1	7.18	North East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.86 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 127 L06_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 127 L06_Copy	**Prop Type Ref**	Unit 127 L06
Property			

SAP Rating	78 C	**DER**	5.43	**TER**	11.48
Environmental	96 A	**% DER < TER**			52.70
CO_2 Emissions (t/year)	0.36	**DFEE**	22.16	**TFEE**	22.99
Compliance Check	See BREL	**% DFEE < TFEE**			3.60
% DPER < TPER	2.48	**DPER**	60.47	**TPER**	62.01

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.4100	(1b)	x 2.4000	(2b) =	159.3840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.4100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		159.3840	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			17.9500	1.2357	22.1816			(27)
External Wall 1	44.8100	17.9500	26.8600	0.1400	3.7604	14.0000	376.0400	(29a)
Total net area of external elements Aum(A, m2)			44.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.9420			(33)
Party Wall 1			55.0200	0.0000	0.0000	20.0000	1100.4000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.4100			80.0000	5312.8000	(32d)
Party Ceiling 1			66.4100			80.0000	5312.8000	(32b)
Internal Wall 1			140.4500			9.0000	1264.0500	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13443.0900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.4257 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240

E4 Jamb	46.4000	0.0500	2.3200	
E7 Party floor between dwellings (in blocks of flats)	33.1800	0.0700	2.3226	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	43.6000	0.0000	0.0000	
E16 Corner (normal)	5.4000	0.0900	0.4860	
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.8766 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 31.8186 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.9138	15.7461	15.5785	14.7402	14.5726	13.7343	13.7343	13.5667	14.0696	14.5726	14.9079	15.2432	(38)
Heat transfer coeff	47.7324	47.5647	47.3970	46.5588	46.3911	45.5529	45.5529	45.3852	45.8882	46.3911	46.7264	47.0617	(39)

Average = Sum(39)m / 12 = 46.5169

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7188	0.7162	0.7137	0.7011	0.6986	0.6859	0.6859	0.6834	0.6910	0.6986	0.7036	0.7087	(40)
HLP (average)												0.7004	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1559 (42)
Hot water usage for mixer showers

83.0050	81.7576	79.9399	76.4620	73.8955	71.0332	69.4063	71.2103	73.1878	76.2609	79.8135	82.6870	(42a)

Hot water usage for baths

26.0831	25.6958	25.1503	24.1445	23.3913	22.5562	22.1051	22.6468	23.2366	24.1302	25.1567	25.9950	(42b)

Hot water usage for other uses

36.7088	35.3739	34.0390	32.7042	31.3693	30.0344	30.0344	31.3693	32.7042	34.0390	35.3739	36.7088	(42c)

Average daily hot water use (litres/day) 134.0826 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7969	142.8273	139.1292	133.3107	128.6561	123.6239	121.5459	125.2264	129.1285	134.4302	140.3441	145.3907	(44)
Energy conte	230.9067	203.3841	213.8364	182.4956	173.1958	152.0100	146.9993	155.0565	159.2284	182.4205	199.9459	227.6467	(45)
Energy content (annual)											Total = Sum(45)m =	2227.1258	
Distribution loss (46)m = 0.15 x (45)m	34.6360	30.5076	32.0755	27.3743	25.9794	22.8015	22.0499	23.2585	23.8843	27.3631	29.9919	34.1470	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h												
251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
									Total per year (kWh/year) = Sum(64)m =		2474.1578	(64)
Electric shower(s)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

93.5611	82.7855	87.8852	76.9230	74.3722	66.7865	65.6619	68.3409	69.1866	77.4394	82.7252	92.4772	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7302	19.3006	15.6963	11.8831	8.8827	7.4992	8.1031	10.5328	14.1371	17.9502	20.9506	22.3341	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.7577	284.6815	277.3137	261.6285	241.8288	223.2199	210.7880	207.8643	215.2321	230.9172	250.7169	269.3258	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	(71)
Water heating gains (Table 5)	125.7542	123.1928	118.1253	106.8375	99.9627	92.7591	88.2552	91.8561	96.0926	104.0853	114.8961	124.2973	(72)
Total internal gains	522.4518	520.3846	504.3451	473.5589	443.8841	416.6880	400.3562	403.4629	418.6715	446.1625	479.7734	509.1670	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.1800	11.2829	0.6300	0.8270	0.7700	29.2500	(75)
Southeast	10.7700	36.7938	0.6300	0.8270	0.7700	143.0771	(77)

Solar gains	172.3271	303.2524	440.7298	589.3413	699.5932	711.9009	679.1212	594.2132	491.7767	342.1167	208.1774	146.3312	(83)
Total gains	694.7789	823.6370	945.0748	1062.9002	1143.4773	1128.5888	1079.4774	997.6761	910.4482	788.2792	687.9508	655.4982	(84)

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7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
tau	78.2319	78.5076	78.7853	80.2038	80.4936	81.9749	81.9749	82.2777	81.3759	80.4936	79.9160	79.3466	
alpha	6.2155	6.2338	6.2524	6.3469	6.3662	6.4650	6.4650	6.4852	6.4251	6.3662	6.3277	6.2898	
util living area	0.9131	0.8285	0.6971	0.5255	0.3768	0.2583	0.1857	0.2093	0.3475	0.6013	0.8375	0.9294	(86)
MIT	20.6593	20.8253	20.9405	20.9900	20.9989	20.9999	21.0000	21.0000	20.9995	20.9822	20.8459	20.6193	(87)
Th 2	20.3243	20.3265	20.3287	20.3399	20.3421	20.3533	20.3533	20.3555	20.3488	20.3421	20.3376	20.3332	(88)
util rest of house	0.8992	0.8074	0.6703	0.4980	0.3503	0.2322	0.1584	0.1799	0.3148	0.5661	0.8136	0.9175	(89)
MIT 2	19.9478	20.1416	20.2698	20.3309	20.3412	20.3532	20.3533	20.3555	20.3485	20.3268	20.1791	19.9082	(90)
Living area fraction									fLA = Living area / (4) =			0.3439	(91)
MIT	20.1925	20.3768	20.5004	20.5576	20.5674	20.5756	20.5757	20.5772	20.5724	20.5522	20.4084	20.1528	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1925	20.3768	20.5004	20.5576	20.5674	20.5756	20.5757	20.5772	20.5724	20.5522	20.4084	20.1528	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8962	0.8090	0.6773	0.5071	0.3594	0.2412	0.1678	0.1900	0.3261	0.5775	0.8163	0.9140	(94)
Useful gains	622.6874	666.3351	640.1115	539.0059	410.9758	272.1869	181.1029	189.5780	296.8563	455.2202	561.5648	599.0967	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	758.5879	736.1473	663.5798	542.7626	411.3686	272.2079	181.1044	189.5813	297.0062	461.6939	621.8538	750.7646	(97)
Space heating kWh	101.1100	46.9138	17.4604	2.7048	0.2923	0.0000	0.0000	0.0000	0.0000	4.8164	43.4080	112.8409	(98a)
Space heating requirement - total per year (kWh/year)												329.5467	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	101.1100	46.9138	17.4604	2.7048	0.2923	0.0000	0.0000	0.0000	0.0000	4.8164	43.4080	112.8409	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												329.5467	
Space heating per m2										(98c) / (4) =		4.9623	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	101.1100	46.9138	17.4604	2.7048	0.2923	0.0000	0.0000	0.0000	0.0000	4.8164	43.4080	112.8409	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	101.1100	46.9138	17.4604	2.7048	0.2923	0.0000	0.0000	0.0000	0.0000	4.8164	43.4080	112.8409	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5604	10.4416	11.5604	11.1874	11.5604	11.1874	11.5604	11.5604	11.1874	11.5604	11.1874	11.5604	(231)
Lighting	19.0203	15.2588	13.7389	10.0657	7.7750	6.3523	7.0926	9.2193	11.9749	15.7117	17.7464	19.5489	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.9234	-25.2128	-40.7922	-51.2787	-60.2280	-57.9694	-57.0463	-51.4863	-42.0498	-30.7081	-18.3023	-13.4296	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.0316	-7.2818	-16.4713	-27.6446	-38.7166	-39.7876	-39.2248	-31.7520	-21.6853	-11.3908	-4.3604	-2.3066	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	329.5467	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2474.1578	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.1139	(230a)
Total electricity for the above, kWh/year	136.1139	(231)
Electricity for lighting (calculated in Appendix L)	153.5048	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-708.0805	(233)
Wind generation	0.0000	(234)

Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2385.2428	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	329.5467	16.4900	54.3423	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	16.4900	407.9886	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	136.1139	16.4900	22.4452	(249)
Energy for lighting	153.5048	16.4900	25.3129	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.4271	16.4900	-76.5840	
PV Unit electricity exported	-243.6534	5.5900	-13.6202	
Total			-90.2042	(252)
Total energy cost			419.8848	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.3568	(257)
SAP value		78.0066	
SAP rating (Section 12)		78	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	329.5467	0.1599	52.6867	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2474.1578	0.1413	349.5790	(264)
Space and water heating			402.2657	(265)
Pumps, fans and electric keep-hot	136.1139	0.1387	18.8807	(267)
Energy for lighting	153.5048	0.1443	22.1555	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.4271	0.1324	-61.4677	
PV Unit electricity exported	-243.6534	0.1232	-30.0120	
Total			-91.4797	(269)
Total CO2, kg/year			351.8222	(272)
CO2 emissions per m2			5.3000	(273)
EI value			95.7684	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.4100 (1b)	x	2.4000 (2b)	=	159.3840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.4100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.3840	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			17.9500	1.2357	22.1816			(27)
External Wall 1	44.8100	17.9500	26.8600	0.1400	3.7604	14.0000	376.0400	(29a)
Total net area of external elements Aum(A, m2)			44.8100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.9420			(33)
Party Wall 1			55.0200	0.0000	0.0000	20.0000	1100.4000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.4100			80.0000	5312.8000	(32d)
Party Ceiling 1			66.4100			80.0000	5312.8000	(32b)
Internal Wall 1			140.4500			9.0000	1264.0500	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13443.0900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 202.4257 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	46.4000	0.0500	2.3200
E7 Party floor between dwellings (in blocks of flats)	33.1800	0.0700	2.3226
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	43.6000	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.8766 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 31.8186 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.0814	16.0814	15.7461	14.7402	14.5726	13.9020	13.5667	13.5667	14.2373	15.0755	15.4108	15.2432	(38)
Heat transfer coeff	47.9000	47.9000	47.5647	46.5588	46.3911	45.7205	45.3852	45.3852	46.0558	46.8941	47.2294	47.0617	(39)

Average = Sum(39)m / 12 = 46.6706

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7213	0.7213	0.7162	0.7011	0.6986	0.6885	0.6834	0.6834	0.6935	0.7061	0.7112	0.7087	(40)
HLP (average)												0.7028	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1559 (42)
Hot water usage for mixer showers

83.0050	81.7576	79.9399	76.4620	73.8955	71.0332	69.4063	71.2103	73.1878	76.2609	79.8135	82.6870	(42a)

Hot water usage for baths

26.0831	25.6958	25.1503	24.1445	23.3913	22.5562	22.1051	22.6468	23.2366	24.1302	25.1567	25.9950	(42b)

Hot water usage for other uses

36.7088	35.3739	34.0390	32.7042	31.3693	30.0344	30.0344	31.3693	32.7042	34.0390	35.3739	36.7088	(42c)

Average daily hot water use (litres/day) 134.0826 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7969	142.8273	139.1292	133.3107	128.6561	123.6239	121.5459	125.2264	129.1285	134.4302	140.3441	145.3907	(44)
Energy conte	230.9067	203.3841	213.8364	182.4956	173.1958	152.0100	146.9993	155.0565	159.2284	182.4205	199.9459	227.6467	(45)
Energy content (annual)										Total = Sum(45)m =		2227.1258	
Distribution loss (46)m = 0.15 x (45)m	34.6360	30.5076	32.0755	27.3743	25.9794	22.8015	22.0499	23.2585	23.8843	27.3631	29.9919	34.1470	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
									Total per year (kWh/year) = Sum(64)m =		2474.1578	(64)
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

93.5611	82.7855	87.8852	76.9230	74.3722	66.7865	65.6619	68.3409	69.1866	77.4394	82.7252	92.4772	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.7302	19.3006	15.6963	11.8831	8.8827	7.4992	8.1031	10.5328	14.1371	17.9502	20.9506	22.3341	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	281.7577	284.6815	277.3137	261.6285	241.8288	223.2199	210.7880	207.8643	215.2321	230.9172	250.7169	269.3258	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	(71)
Water heating gains (Table 5)													
	125.7542	123.1928	118.1253	106.8375	99.9627	92.7591	88.2552	91.8561	96.0926	104.0853	114.8961	124.2973	(72)
Total internal gains													
	522.4518	520.3846	504.3451	473.5589	443.8841	416.6880	400.3562	403.4629	418.6715	446.1625	479.7734	509.1670	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.1800	10.0309	0.6300	0.8270	0.7700	26.0043	(75)
Southeast	10.7700	33.4622	0.6300	0.8270	0.7700	130.1217	(77)

Solar gains	156.1260	292.8617	444.0892	624.2330	734.0110	726.4143	701.3537	596.2354	490.8624	328.1960	193.7601	135.6247	(83)
Total gains	678.5779	813.2463	948.4342	1097.7919	1177.8951	1143.1023	1101.7099	999.6983	909.5339	774.3585	673.5335	644.7917	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	77.9581	77.9581	78.5076	80.2038	80.4936	81.6743	82.2777	82.2777	81.0797	79.6303	79.0650	79.3466	
alpha	6.1972	6.1972	6.2338	6.3469	6.3662	6.4450	6.4852	6.4852	6.4053	6.3087	6.2710	6.2898	
util living area													
	0.9280	0.8538	0.7308	0.5496	0.4049	0.3119	0.2513	0.2814	0.4143	0.6633	0.8666	0.9413	(86)
MIT	20.6037	20.7792	20.9175	20.9861	20.9981	20.9997	20.9999	20.9999	20.9983	20.9658	20.7978	20.5651	(87)
Th 2	20.3221	20.3221	20.3265	20.3399	20.3421	20.3510	20.3555	20.3555	20.3466	20.3354	20.3310	20.3332	(88)
util rest of house													
	0.9160	0.8349	0.7057	0.5232	0.3793	0.2860	0.2247	0.2522	0.3816	0.6292	0.8456	0.9312	(89)
MIT 2	19.8790	20.0845	20.2427	20.3270	20.3405	20.3508	20.3555	20.3554	20.3453	20.3044	20.1185	19.8422	(90)
Living area fraction										fLA = Living area / (4) =		0.3439	(91)
MIT	20.1283	20.3234	20.4748	20.5537	20.5667	20.5740	20.5771	20.5771	20.5699	20.5318	20.3521	20.0908	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1283	20.3234	20.4748	20.5537	20.5667	20.5740	20.5771	20.5771	20.5699	20.5318	20.3521	20.0908	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9123	0.8349	0.7113	0.5318	0.3880	0.2949	0.2339	0.2622	0.3928	0.6394	0.8463	0.9271	(94)
Useful gains	619.0447	679.0146	674.6492	583.8316	457.0442	337.0525	257.6417	262.1613	357.2981	495.1389	570.0198	597.8034	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	777.3341	767.5228	707.5154	589.1411	457.7265	337.1434	257.6576	262.1942	357.8503	507.9494	649.5037	771.3798	(97)
Space heating kWh													
	117.7673	59.4775	24.4524	3.8228	0.5077	0.0000	0.0000	0.0000	0.0000	9.5310	57.2284	129.1409	(98a)
Space heating requirement - total per year (kWh/year)												401.9281	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	117.7673	59.4775	24.4524	3.8228	0.5077	0.0000	0.0000	0.0000	0.0000	9.5310	57.2284	129.1409	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												401.9281	
Space heating per m2											(98c) / (4) =	6.0522	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	117.7673	59.4775	24.4524	3.8228	0.5077	0.0000	0.0000	0.0000	0.0000	9.5310	57.2284	129.1409	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	117.7673	59.4775	24.4524	3.8228	0.5077	0.0000	0.0000	0.0000	0.0000	9.5310	57.2284	129.1409	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
Efficiency of water heater												100.0000	(216)

(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5604	10.4416	11.5604	11.1874	11.5604	11.1874	11.5604	11.5604	11.1874	11.5604	11.1874	11.5604	(231)
Lighting	19.0203	15.2588	13.7389	10.0657	7.7750	6.3523	7.0926	9.2193	11.9749	15.7117	17.7464	19.5489	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.4401	-24.3169	-40.8785	-53.4755	-62.3556	-58.8113	-58.3661	-51.5020	-41.7727	-29.4676	-17.0519	-12.4234	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.5486	-6.7456	-16.3654	-29.7651	-41.3009	-40.8915	-40.9673	-31.7699	-21.4298	-10.5342	-3.8166	-2.0047	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	401.9281	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2474.1578	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.1139	(230a)
Total electricity for the above, kWh/year	136.1139	(231)
Electricity for lighting (calculated in Appendix L)	153.5048	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-713.0011	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2452.7035	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	401.9281	25.1600	101.1251	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	25.1600	622.4981	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	136.1139	25.1600	34.2463	(249)
Energy for lighting	153.5048	25.1600	38.6218	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.8615	25.1600	-116.9592	
PV Unit electricity exported	-248.1396	5.8100	-14.4169	
Total			-131.3761	(252)
Total energy cost			665.1152	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	401.9281	0.1594	64.0550	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2474.1578	0.1413	349.5790	(264)
Space and water heating			413.6341	(265)
Pumps, fans and electric keep-hot	136.1139	0.1387	18.8807	(267)
Energy for lighting	153.5048	0.1443	22.1555	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.8615	0.1320	-61.3847	
PV Unit electricity exported	-248.1396	0.1227	-30.4360	
Total			-91.8207	(269)
Total CO2, kg/year			362.8495	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	401.9281	1.5898	638.9946	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	1.5225	3766.8228	(278)
Space and water heating			4405.8174	(279)
Pumps, fans and electric keep-hot	136.1139	1.5128	205.9132	(281)
Energy for lighting	153.5048	1.5338	235.4508	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.8615	1.4879	-691.6650	
PV Unit electricity exported	-248.1396	0.4501	-111.6992	
Total			-803.3642	(283)
Total Primary energy kWh/year			4043.8172	(286)

SAP 10 EPC IMPROVEMENTS

Unit 127 L06_Copy

Current energy efficiency rating: C 78
Current environmental impact rating: A 96

N	Solar water heating	Not applicable
U	Solar photovoltaic panels	Not applicable
V2	Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 78
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£796	£796	£0
Space heating	£135	£135	£0
Water heating	£622	£622	£0
Lighting	£39	£39	£0
Generated (PV)	-£131	-£131	£0
Total cost of fuels	£665	£665	£0
Total cost of uses	£665	£665	£0
Delivered energy	37 kWh/m²	37 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	61 kWh/m²	61 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.4100	(1b)	x 2.4000	(2b) =	159.3840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.4100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		159.3840	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			17.9500	1.2357	22.1816			(27)
External Wall 1	44.8100	17.9500	26.8600	0.1400	3.7604	14.0000	376.0400	(29a)
Total net area of external elements Aum(A, m2)			44.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.9420			(33)
Party Wall 1			55.0200	0.0000	0.0000	20.0000	1100.4000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.4100			80.0000	5312.8000	(32d)
Party Ceiling 1			66.4100			80.0000	5312.8000	(32b)
Internal Wall 1			140.4500			9.0000	1264.0500	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13443.0900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 202.4257 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	46.4000	0.0500	2.3200
E7 Party floor between dwellings (in blocks of flats)	33.1800	0.0700	2.3226
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	43.6000	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.8766 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 31.8186 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.9138	15.7461	15.5785	14.7402	14.5726	13.7343	13.7343	13.5667	14.0696	14.5726	14.9079	15.2432	(38)
Heat transfer coeff	47.7324	47.5647	47.3970	46.5588	46.3911	45.5529	45.5529	45.3852	45.8882	46.3911	46.7264	47.0617	(39)
Average = Sum(39)m / 12 =												46.5169	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7188	0.7162	0.7137	0.7011	0.6986	0.6859	0.6859	0.6834	0.6910	0.6986	0.7036	0.7087	(40)
HLP (average)												0.7004	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1559 (42)
Hot water usage for mixer showers

83.0050	81.7576	79.9399	76.4620	73.8955	71.0332	69.4063	71.2103	73.1878	76.2609	79.8135	82.6870	(42a)

Hot water usage for baths

26.0831	25.6958	25.1503	24.1445	23.3913	22.5562	22.1051	22.6468	23.2366	24.1302	25.1567	25.9950	(42b)

Hot water usage for other uses

36.7088	35.3739	34.0390	32.7042	31.3693	30.0344	30.0344	31.3693	32.7042	34.0390	35.3739	36.7088	(42c)

Average daily hot water use (litres/day) 134.0826 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7969	142.8273	139.1292	133.3107	128.6561	123.6239	121.5459	125.2264	129.1285	134.4302	140.3441	145.3907	(44)
Energy conte	230.9067	203.3841	213.8364	182.4956	173.1958	152.0100	146.9993	155.0565	159.2284	182.4205	199.9459	227.6467	(45)
Energy content (annual)										Total = Sum(45)m =		2227.1258	
Distribution loss (46)m = 0.15 x (45)m	34.6360	30.5076	32.0755	27.3743	25.9794	22.8015	22.0499	23.2585	23.8843	27.3631	29.9919	34.1470	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
									Total per year (kWh/year) = Sum(64)m =			2474.1578	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	93.5611	82.7855	87.8852	76.9230	74.3722	66.7865	65.6619	68.3409	69.1866	77.4394	82.7252	92.4772	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7302	19.3006	15.6963	11.8831	8.8827	7.4992	8.1031	10.5328	14.1371	17.9502	20.9506	22.3341	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.7577	284.6815	277.3137	261.6285	241.8288	223.2199	210.7880	207.8643	215.2321	230.9172	250.7169	269.3258	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	(71)
Water heating gains (Table 5)													

	125.7542	123.1928	118.1253	106.8375	99.9627	92.7591	88.2552	91.8561	96.0926	104.0853	114.8961	124.2973	(72)
Total internal gains													
	522.4518	520.3846	504.3451	473.5589	443.8841	416.6880	400.3562	403.4629	418.6715	446.1625	479.7734	509.1670	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.1800	11.2829	0.6300	0.8270	0.7700	29.2500	(75)
Southeast	10.7700	36.7938	0.6300	0.8270	0.7700	143.0771	(77)

Solar gains	172.3271	303.2524	440.7298	589.3413	699.5932	711.9009	679.1212	594.2132	491.7767	342.1167	208.1774	146.3312	(83)
Total gains	694.7789	823.6370	945.0748	1062.9002	1143.4773	1128.5888	1079.4774	997.6761	910.4482	788.2792	687.9508	655.4982	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.2319	78.5076	78.7853	80.2038	80.4936	81.9749	81.9749	82.2777	81.3759	80.4936	79.9160	79.3466	
alpha	6.2155	6.2338	6.2524	6.3469	6.3662	6.4650	6.4650	6.4852	6.4251	6.3662	6.3277	6.2898	
util living area													
	0.9131	0.8285	0.6971	0.5255	0.3768	0.2583	0.1857	0.2093	0.3475	0.6013	0.8375	0.9294	(86)
MIT	20.6593	20.8253	20.9405	20.9900	20.9989	20.9999	21.0000	21.0000	20.9995	20.9822	20.8459	20.6193	(87)
Th 2	20.3243	20.3265	20.3287	20.3399	20.3421	20.3533	20.3533	20.3555	20.3488	20.3421	20.3376	20.3332	(88)
util rest of house													
	0.8992	0.8074	0.6703	0.4980	0.3503	0.2322	0.1584	0.1799	0.3148	0.5661	0.8136	0.9175	(89)
MIT 2	19.9478	20.1416	20.2698	20.3309	20.3412	20.3532	20.3533	20.3555	20.3485	20.3268	20.1791	19.9082	(90)
Living area fraction										fLA = Living area / (4) =		0.3439	(91)
MIT	20.1925	20.3768	20.5004	20.5576	20.5674	20.5756	20.5757	20.5772	20.5724	20.5522	20.4084	20.1528	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1925	20.3768	20.5004	20.5576	20.5674	20.5756	20.5757	20.5772	20.5724	20.5522	20.4084	20.1528	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8962	0.8090	0.6773	0.5071	0.3594	0.2412	0.1678	0.1900	0.3261	0.5775	0.8163	0.9140	(94)
Useful gains	622.6874	666.3351	640.1115	539.0059	410.9758	272.1869	181.1029	189.5780	296.8563	455.2202	561.5648	599.0967	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	758.5879	736.1473	663.5798	542.7626	411.3686	272.2079	181.1044	189.5813	297.0062	461.6939	621.8538	750.7646	(97)
Space heating kWh													
	101.1100	46.9138	17.4604	2.7048	0.2923	0.0000	0.0000	0.0000	0.0000	4.8164	43.4080	112.8409	(98a)
Space heating requirement - total per year (kWh/year)												329.5467	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	101.1100	46.9138	17.4604	2.7048	0.2923	0.0000	0.0000	0.0000	0.0000	4.8164	43.4080	112.8409	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												329.5467	
Space heating per m2											(98c) / (4) =	4.9623	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	101.1100	46.9138	17.4604	2.7048	0.2923	0.0000	0.0000	0.0000	0.0000	4.8164	43.4080	112.8409	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	101.1100	46.9138	17.4604	2.7048	0.2923	0.0000	0.0000	0.0000	0.0000	4.8164	43.4080	112.8409	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5604	10.4416	11.5604	11.1874	11.5604	11.1874	11.5604	11.5604	11.1874	11.5604	11.1874	11.5604	(231)
Lighting	19.0203	15.2588	13.7389	10.0657	7.7750	6.3523	7.0926	9.2193	11.9749	15.7117	17.7464	19.5489	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.9234	-25.2128	-40.7922	-51.2787	-60.2280	-57.9694	-57.0463	-51.4863	-42.0498	-30.7081	-18.3023	-13.4296	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													

(233b)m	-3.0316	-7.2818	-16.4713	-27.6446	-38.7166	-39.7876	-39.2248	-31.7520	-21.6853	-11.3908	-4.3604	-2.3066	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	329.5467	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2474.1578	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.1139	(230a)
Total electricity for the above, kWh/year	136.1139	(231)
Electricity for lighting (calculated in Appendix L)	153.5048	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-708.0805	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2385.2428	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	329.5467	16.4900	54.3423	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	16.4900	407.9886	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	136.1139	16.4900	22.4452	(249)
Energy for lighting	153.5048	16.4900	25.3129	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.4271	16.4900	-76.5840	
PV Unit electricity exported	-243.6534	5.5900	-13.6202	
Total			-90.2042	(252)
Total energy cost			419.8848	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.3568	(257)
SAP value		78.0066	
SAP rating (Section 12)		78	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	329.5467	0.1599	52.6867	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2474.1578	0.1413	349.5790	(264)
Space and water heating			402.2657	(265)
Pumps, fans and electric keep-hot	136.1139	0.1387	18.8807	(267)
Energy for lighting	153.5048	0.1443	22.1555	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.4271	0.1324	-61.4677	
PV Unit electricity exported	-243.6534	0.1232	-30.0120	
Total			-91.4797	(269)
Total CO2, kg/year			351.8222	(272)
CO2 emissions per m2			5.3000	(273)
EI value			95.7684	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		66.4100 (1b)	x	2.4000 (2b)	=	159.3840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.4100						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.3840	(5)

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2. Ventilation rate
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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			17.9500	1.2357	22.1816			(27)
External Wall 1	44.8100	17.9500	26.8600	0.1400	3.7604	14.0000	376.0400	(29a)
Total net area of external elements Aum(A, m2)			44.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.9420			(33)
Party Wall 1			55.0200	0.0000	0.0000	20.0000	1100.4000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.4100			80.0000	5312.8000	(32d)
Party Ceiling 1			66.4100			80.0000	5312.8000	(32b)
Internal Wall 1			140.4500			9.0000	1264.0500	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13443.0900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.4257 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	46.4000	0.0500	2.3200
E7 Party floor between dwellings (in blocks of flats)	33.1800	0.0700	2.3226
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	43.6000	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.8766 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	31.8186 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.0814	16.0814	15.7461	14.7402	14.5726	13.9020	13.5667	13.5667	14.2373	15.0755	15.4108	15.2432	(38)
Heat transfer coeff	47.9000	47.9000	47.5647	46.5588	46.3911	45.7205	45.3852	45.3852	46.0558	46.8941	47.2294	47.0617	(39)
Average = Sum(39)m / 12 =												46.6706	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7213	0.7213	0.7162	0.7011	0.6986	0.6885	0.6834	0.6834	0.6935	0.7061	0.7112	0.7087	(40)
HLP (average)												0.7028	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1559	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
83.0050	81.7576	79.9399	76.4620	73.8955	71.0332	69.4063	71.2103	73.1878	76.2609	79.8135	82.6870	(42a)

Hot water usage for baths

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
26.0831	25.6958	25.1503	24.1445	23.3913	22.5562	22.1051	22.6468	23.2366	24.1302	25.1567	25.9950	(42b)

Hot water usage for other uses

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
36.7088	35.3739	34.0390	32.7042	31.3693	30.0344	30.0344	31.3693	32.7042	34.0390	35.3739	36.7088	(42c)

Average daily hot water use (litres/day)	134.0826 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7969	142.8273	139.1292	133.3107	128.6561	123.6239	121.5459	125.2264	129.1285	134.4302	140.3441	145.3907	(44)
Energy conte	230.9067	203.3841	213.8364	182.4956	173.1958	152.0100	146.9993	155.0565	159.2284	182.4205	199.9459	227.6467	(45)
Energy content (annual)										Total = Sum(45)m =		2227.1258	

Distribution loss (46)m = 0.15 x (45)m

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
34.6360	30.5076	32.0755	27.3743	25.9794	22.8015	22.0499	23.2585	23.8843	27.3631	29.9919	34.1470	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)

Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
										Total per year (kWh/year) = Sum(64)m =		2474.1578	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	93.5611	82.7855	87.8852	76.9230	74.3722	66.7865	65.6619	68.3409	69.1866	77.4394	82.7252	92.4772	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.7302	19.3006	15.6963	11.8831	8.8827	7.4992	8.1031	10.5328	14.1371	17.9502	20.9506	22.3341	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	281.7577	284.6815	277.3137	261.6285	241.8288	223.2199	210.7880	207.8643	215.2321	230.9172	250.7169	269.3258	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	(71)
Water heating gains (Table 5)													
	125.7542	123.1928	118.1253	106.8375	99.9627	92.7591	88.2552	91.8561	96.0926	104.0853	114.8961	124.2973	(72)
Total internal gains													
	522.4518	520.3846	504.3451	473.5589	443.8841	416.6880	400.3562	403.4629	418.6715	446.1625	479.7734	509.1670	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.1800	10.0309	0.6300	0.8270	0.7700	26.0043	(75)
Southeast	10.7700	33.4622	0.6300	0.8270	0.7700	130.1217	(77)

Solar gains	156.1260	292.8617	444.0892	624.2330	734.0110	726.4143	701.3537	596.2354	490.8624	328.1960	193.7601	135.6247	(83)
Total gains	678.5779	813.2463	948.4342	1097.7919	1177.8951	1143.1023	1101.7099	999.6983	909.5339	774.3585	673.5335	644.7917	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	77.9581	77.9581	78.5076	80.2038	80.4936	81.6743	82.2777	82.2777	81.0797	79.6303	79.0650	79.3466	
alpha	6.1972	6.1972	6.2338	6.3469	6.3662	6.4450	6.4852	6.4852	6.4053	6.3087	6.2710	6.2898	
util living area													
	0.9280	0.8538	0.7308	0.5496	0.4049	0.3119	0.2513	0.2814	0.4143	0.6633	0.8666	0.9413	(86)
MIT	20.6037	20.7792	20.9175	20.9861	20.9981	20.9997	20.9999	20.9999	20.9983	20.9658	20.7978	20.5651	(87)
Th 2	20.3221	20.3221	20.3265	20.3399	20.3421	20.3510	20.3555	20.3555	20.3466	20.3354	20.3310	20.3332	(88)
util rest of house													
	0.9160	0.8349	0.7057	0.5232	0.3793	0.2860	0.2247	0.2522	0.3816	0.6292	0.8456	0.9312	(89)
MIT 2	19.8790	20.0845	20.2427	20.3270	20.3405	20.3508	20.3555	20.3554	20.3453	20.3044	20.1185	19.8422	(90)
Living area fraction										fLA = Living area / (4) =		0.3439	(91)
MIT	20.1283	20.3234	20.4748	20.5537	20.5667	20.5740	20.5771	20.5771	20.5699	20.5318	20.3521	20.0908	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1283	20.3234	20.4748	20.5537	20.5667	20.5740	20.5771	20.5771	20.5699	20.5318	20.3521	20.0908	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9123	0.8349	0.7113	0.5318	0.3880	0.2949	0.2339	0.2622	0.3928	0.6394	0.8463	0.9271	(94)
Useful gains	619.0447	679.0146	674.6492	583.8316	457.0442	337.0525	257.6417	262.1613	357.2981	495.1389	570.0198	597.8034	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	777.3341	767.5228	707.5154	589.1411	457.7265	337.1434	257.6576	262.1942	357.8503	507.9494	649.5037	771.3798	(97)
Space heating kWh													
	117.7673	59.4775	24.4524	3.8228	0.5077	0.0000	0.0000	0.0000	0.0000	9.5310	57.2284	129.1409	(98a)
Space heating requirement - total per year (kWh/year)												401.9281	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	117.7673	59.4775	24.4524	3.8228	0.5077	0.0000	0.0000	0.0000	0.0000	9.5310	57.2284	129.1409	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												401.9281	
Space heating per m2											(98c) / (4) =	6.0522	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	117.7673	59.4775	24.4524	3.8228	0.5077	0.0000	0.0000	0.0000	0.0000	9.5310	57.2284	129.1409	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	117.7673	59.4775	24.4524	3.8228	0.5077	0.0000	0.0000	0.0000	0.0000	9.5310	57.2284	129.1409	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5604	10.4416	11.5604	11.1874	11.5604	11.1874	11.5604	11.5604	11.1874	11.5604	11.1874	11.5604	(231)
Lighting	19.0203	15.2588	13.7389	10.0657	7.7750	6.3523	7.0926	9.2193	11.9749	15.7117	17.7464	19.5489	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.4401	-24.3169	-40.8785	-53.4755	-62.3556	-58.8113	-58.3661	-51.5020	-41.7727	-29.4676	-17.0519	-12.4234	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.5486	-6.7456	-16.3654	-29.7651	-41.3009	-40.8915	-40.9673	-31.7699	-21.4298	-10.5342	-3.8166	-2.0047	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												401.9281	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2474.1578	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)													
mechanical ventilation fans (SFP = 0.7000)												136.1139	(230a)
Total electricity for the above, kWh/year												136.1139	(231)
Electricity for lighting (calculated in Appendix L)												153.5048	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-713.0011	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2452.7035	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	401.9281	25.1600	101.1251	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	25.1600	622.4981	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	136.1139	25.1600	34.2463	(249)
Energy for lighting	153.5048	25.1600	38.6218	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.8615	25.1600	-116.9592	
PV Unit electricity exported	-248.1396	5.8100	-14.4169	
Total			-131.3761	(252)
Total energy cost			665.1152	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	401.9281	0.1594	64.0550	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2474.1578	0.1413	349.5790	(264)
Space and water heating			413.6341	(265)
Pumps, fans and electric keep-hot	136.1139	0.1387	18.8807	(267)
Energy for lighting	153.5048	0.1443	22.1555	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.8615	0.1320	-61.3847	
PV Unit electricity exported	-248.1396	0.1227	-30.4360	
Total			-91.8207	(269)
Total CO2, kg/year			362.8495	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	401.9281	1.5898	638.9946	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	1.5225	3766.8228	(278)
Space and water heating			4405.8174	(279)
Pumps, fans and electric keep-hot	136.1139	1.5128	205.9132	(281)
Energy for lighting	153.5048	1.5338	235.4508	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.8615	1.4879	-691.6650	
PV Unit electricity exported	-248.1396	0.4501	-111.6992	
Total			-803.3642	(283)
Total Primary energy kWh/year			4043.8172	(286)

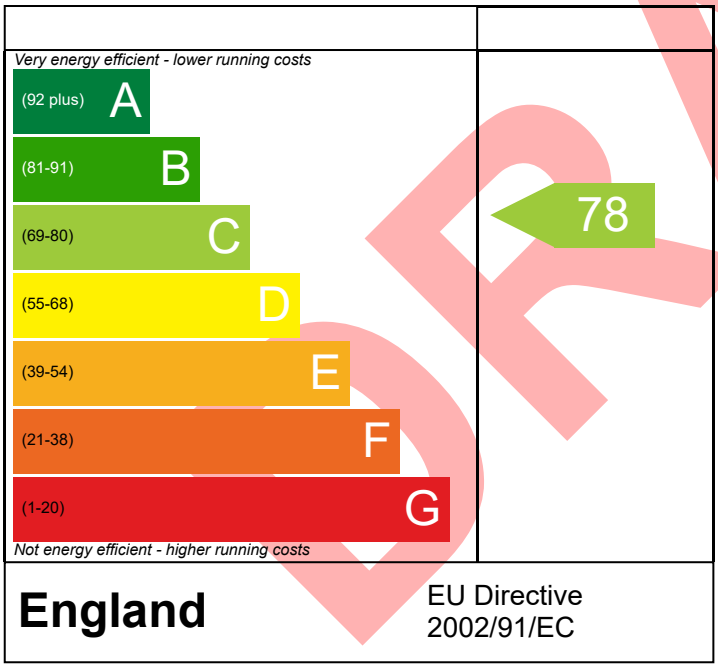
Predicted Energy Assessment

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	66.41 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

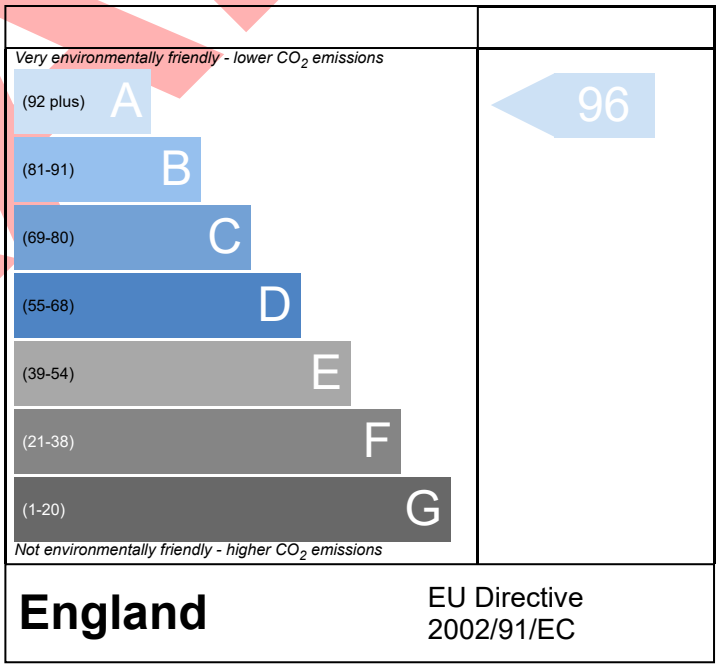
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:22

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	73 m^2
Site Reference	Unit 128 L06_Copy	Plot Reference	Unit 128 L06_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*9.4 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	4.36 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*50.86 kWh$_{PE}$/m^2*	
Dwelling primary energy	49.68 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*13.4 kWh/m^2*	
Dwelling fabric energy efficiency	12.1 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	13.83	0.14 **(!)**
Party wall: Party Wall (1)	46.44	0 **(!)**
Party wall: Party Wall (2)	22.81	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	8.98	South West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.94 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 128 L06_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 128 L06_Copy	**Prop Type Ref**	Unit 128 L06
Property			

SAP Rating	81 B	**DER**	4.36	**TER**	9.40
Environmental	96 A	**% DER < TER**			53.62
CO_2 Emissions (t/year)	0.32	**DFEE**	12.07	**TFEE**	13.36
Compliance Check	See BREL	**% DFEE < TFEE**			9.63
% DPER < TPER	2.32	**DPER**	49.68	**TPER**	50.86

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	72.6700 (1b)	x	2.4000 (2b)	=	174.4080	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.6700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	174.4080	(5)

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2. Ventilation rate

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	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			8.9800	1.2357	11.0970			(27)
External Wall 1	22.8100	8.9800	13.8300	0.1400	1.9362	14.0000	193.6200	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		13.0332			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			72.6700			80.0000	5813.6000	(32d)
Party Ceiling 1			72.6700			80.0000	5813.6000	(32b)
Internal Wall 1			139.0500			9.0000	1251.4500	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 14457.2700	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.9441	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.8600	0.0500	0.1930

E4 Jamb	23.2000	0.0500	1.1600	
E7 Party floor between dwellings (in blocks of flats)	16.9000	0.0700	1.1830	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	51.3000	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.8600 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 15.8932 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.5883	16.4211	16.2538	15.4174	15.2502	14.4138	14.4138	14.2466	14.7484	15.2502	15.5847	15.9193	(38)
Heat transfer coeff	32.4815	32.3142	32.1469	31.3106	31.1433	30.3070	30.3070	30.1397	30.6415	31.1433	31.4779	31.8124	(39)
Average = Sum(39)m / 12 =												31.2688	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4470	0.4447	0.4424	0.4309	0.4286	0.4170	0.4170	0.4147	0.4217	0.4286	0.4332	0.4378	(40)
HLP (average)												0.4303	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3092 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	86.5380	85.2375	83.3424	79.7165	77.0407	74.0567	72.3605	74.2413	76.3029	79.5069	83.2106	86.2064	(42a)
Hot water usage for baths	27.1881	26.7843	26.2157	25.1673	24.3822	23.5118	23.0416	23.6062	24.2210	25.1524	26.2224	27.0962	(42b)
Hot water usage for other uses	38.2781	36.8862	35.4943	34.1023	32.7104	31.3185	31.3185	32.7104	34.1023	35.4943	36.8862	38.2781	(42c)
Average daily hot water use (litres/day)												139.7911	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	152.0042	148.9080	145.0524	138.9861	134.1333	128.8869	126.7206	130.5579	134.6262	140.1535	146.3193	151.5807	(44)
Energy conte	240.7375	212.0430	222.9401	190.2651	180.5693	158.4815	153.2575	161.6579	166.0076	190.1870	208.4586	237.3388	(45)
Energy content (annual)										Total = Sum(45)m =		2321.9438	
Distribution loss (46)m = 0.15 x (45)m	36.1106	31.8064	33.4410	28.5398	27.0854	23.7722	22.9886	24.2487	24.9011	28.5281	31.2688	35.6008	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	261.7183	230.9934	243.9209	210.5691	201.5501	178.7855	174.2383	182.6387	186.3116	211.1678	228.7626	258.3196	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	261.7183	230.9934	243.9209	210.5691	201.5501	178.7855	174.2383	182.6387	186.3116	211.1678	228.7626	258.3196	(64)
										Total per year (kWh/year) = Sum(64)m =		2568.9758	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	96.8299	85.6646	90.9122	79.5063	76.8239	68.9383	67.7428	70.5359	71.4407	80.0218	85.5557	95.6998	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	138.5497	138.5497	138.5497	138.5497	138.5497	138.5497	138.5497	138.5497	138.5497	138.5497	138.5497	138.5497	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.8981	22.1143	17.9845	13.6154	10.1777	8.5924	9.2844	12.0683	16.1980	20.5671	24.0048	25.5901	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	303.6518	306.8028	298.8625	281.9585	260.6203	240.5654	227.1674	224.0165	231.9568	248.8608	270.1990	290.2539	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.1641	51.1641	51.1641	51.1641	51.1641	51.1641	51.1641	51.1641	51.1641	51.1641	51.1641	51.1641	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-92.3665	-92.3665	-92.3665	-92.3665	-92.3665	-92.3665	-92.3665	-92.3665	-92.3665	-92.3665	-92.3665	-92.3665	(71)
Water heating gains (Table 5)	130.1477	127.4771	122.1938	110.4255	103.2580	95.7476	91.0521	94.8063	99.2232	107.5562	118.8273	128.6287	(72)
Total internal gains	556.0450	553.7415	536.3882	503.3468	471.4033	442.2528	424.8514	428.2384	444.7254	474.3314	510.3785	541.8201	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	8.9800	36.7938	0.6300	0.8270	0.7700	119.2973	(79)

Solar gains	119.2973	203.2075	278.0373	344.5017	385.8706	383.0802	369.3302	338.4671	301.0556	224.5875	142.8907	102.0936	(83)
Total gains	675.3423	756.9490	814.4255	847.8485	857.2739	825.3330	794.1816	766.7056	745.7810	698.9190	653.2692	643.9138	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	123.6368	124.2768	124.9235	128.2603	128.9492	132.5076	132.5076	133.2430	131.0609	128.9492	127.5788	126.2372	
alpha	9.2425	9.2851	9.3282	9.5507	9.5966	9.8338	9.8338	9.8829	9.7374	9.5966	9.5053	9.4158	
util living area													
	0.7799	0.6806	0.5710	0.4467	0.3378	0.2350	0.1679	0.1808	0.2835	0.4633	0.6648	0.8015	(86)
MIT	20.9673	20.9894	20.9977	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9998	20.9932	20.9618	(87)
Th 2	20.5697	20.5718	20.5739	20.5846	20.5867	20.5974	20.5974	20.5996	20.5932	20.5867	20.5825	20.5782	(88)
util rest of house													
	0.7633	0.6636	0.5545	0.4314	0.3228	0.2202	0.1525	0.1651	0.2668	0.4449	0.6458	0.7855	(89)
MIT 2	20.5351	20.5609	20.5717	20.5844	20.5867	20.5974	20.5974	20.5996	20.5932	20.5866	20.5758	20.5376	(90)
Living area fraction										fLA = Living area / (4) =		0.4044	(91)
MIT	20.7099	20.7342	20.7440	20.7524	20.7539	20.7603	20.7603	20.7615	20.7577	20.7537	20.7446	20.7091	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7099	20.7342	20.7440	20.7524	20.7539	20.7603	20.7603	20.7615	20.7577	20.7537	20.7446	20.7091	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7688	0.6701	0.5611	0.4376	0.3289	0.2262	0.1588	0.1715	0.2735	0.4523	0.6532	0.7906	(94)
Useful gains	519.1886	507.2217	456.9671	371.0283	281.9633	186.6986	126.0847	131.4552	204.0016	316.1335	426.7379	509.0512	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	533.0183	511.6701	457.9011	371.1064	281.9677	186.6987	126.0847	131.4552	204.0021	316.2192	429.5039	525.1957	(97)
Space heating kWh													
	10.2893	2.9894	0.6949	0.0562	0.0033	0.0000	0.0000	0.0000	0.0000	0.0638	1.9916	12.0115	(98a)
Space heating requirement - total per year (kWh/year)												28.0999	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	10.2893	2.9894	0.6949	0.0562	0.0033	0.0000	0.0000	0.0000	0.0000	0.0638	1.9916	12.0115	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												28.0999	
Space heating per m2											(98c) / (4) =	0.3867	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	10.2893	2.9894	0.6949	0.0562	0.0033	0.0000	0.0000	0.0000	0.0000	0.0638	1.9916	12.0115	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	10.2893	2.9894	0.6949	0.0562	0.0033	0.0000	0.0000	0.0000	0.0000	0.0638	1.9916	12.0115	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	261.7183	230.9934	243.9209	210.5691	201.5501	178.7855	174.2383	182.6387	186.3116	211.1678	228.7626	258.3196	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	261.7183	230.9934	243.9209	210.5691	201.5501	178.7855	174.2383	182.6387	186.3116	211.1678	228.7626	258.3196	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.4091	12.1114	13.4091	12.9765	13.4091	12.9765	13.4091	13.4091	12.9765	13.4091	12.9765	13.4091	(231)
Lighting	21.7931	17.4833	15.7417	11.5331	8.9085	7.2783	8.1266	10.5633	13.7207	18.0022	20.3335	22.3988	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-17.0948	-27.1131	-44.0860	-55.5994	-65.3077	-62.8415	-61.8427	-55.8530	-45.6671	-33.3416	-19.7403	-14.4153	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.6234	-8.4043	-18.5044	-30.6656	-42.8411	-44.0091	-43.3839	-35.1285	-23.9968	-12.6734	-5.0306	-2.7847	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	28.0999	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2568.9758	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	157.8811	(230a)
Total electricity for the above, kWh/year	157.8811	(231)
Electricity for lighting (calculated in Appendix L)	175.8832	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-773.9484	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2156.8915	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	28.0999	16.4900	4.6337	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2568.9758	16.4900	423.6241	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	157.8811	16.4900	26.0346	(249)
Energy for lighting	175.8832	16.4900	29.0031	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-502.9026	16.4900	-82.9286	
PV Unit electricity exported	-271.0458	5.5900	-15.1515	
Total			-98.0801	(252)
Total energy cost			385.2154	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1785	(257)
SAP value		80.8960	
SAP rating (Section 12)		81	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	28.0999	0.1615	4.5375	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2568.9758	0.1413	363.0032	(264)
Space and water heating			367.5407	(265)
Pumps, fans and electric keep-hot	157.8811	0.1387	21.9001	(267)
Energy for lighting	175.8832	0.1443	25.3854	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-502.9026	0.1323	-66.5384	
PV Unit electricity exported	-271.0458	0.1235	-33.4742	
Total			-100.0126	(269)
Total CO2, kg/year			314.8136	(272)
CO2 emissions per m2			4.3300	(273)
EI value			96.4150	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		72.6700 (1b)	x	2.4000 (2b)	=	174.4080	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.6700						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	174.4080	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			8.9800	1.2357	11.0970			(27)
External Wall 1	22.8100	8.9800	13.8300	0.1400	1.9362	14.0000	193.6200	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		13.0332			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			72.6700			80.0000	5813.6000	(32d)
Party Ceiling 1			72.6700			80.0000	5813.6000	(32b)
Internal Wall 1			139.0500			9.0000	1251.4500	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14457.2700 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 198.9441 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.8600	0.0500	0.1930
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.9000	0.0700	1.1830
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	51.3000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.8600 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 15.8932 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.7556	16.7556	16.4211	15.4174	15.2502	14.5811	14.2466	14.2466	14.9156	15.7520	16.0865	15.9193	(38)
Heat transfer coeff	32.6488	32.6488	32.3142	31.3106	31.1433	30.4743	30.1397	30.1397	30.8088	31.6451	31.9797	31.8124	(39)

Average = Sum(39)m / 12 = 31.4221

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4493	0.4493	0.4447	0.4309	0.4286	0.4194	0.4147	0.4147	0.4240	0.4355	0.4401	0.4378	(40)
HLP (average)												0.4324	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3092 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	86.5380	85.2375	83.3424	79.7165	77.0407	74.0567	72.3605	74.2413	76.3029	79.5069	83.2106	86.2064	(42a)
Hot water usage for baths	27.1881	26.7843	26.2157	25.1673	24.3822	23.5118	23.0416	23.6062	24.2210	25.1524	26.2224	27.0962	(42b)
Hot water usage for other uses	38.2781	36.8862	35.4943	34.1023	32.7104	31.3185	31.3185	32.7104	34.1023	35.4943	36.8862	38.2781	(42c)

Average daily hot water use (litres/day) 139.7911 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	152.0042	148.9080	145.0524	138.9861	134.1333	128.8869	126.7206	130.5579	134.6262	140.1535	146.3193	151.5807	(44)
Energy conte	240.7375	212.0430	222.9401	190.2651	180.5693	158.4815	153.2575	161.6579	166.0076	190.1870	208.4586	237.3388	(45)

Energy content (annual) Total = Sum(45)m = 2321.9438

Distribution loss (46)m = 0.15 x (45)m	36.1106	31.8064	33.4410	28.5398	27.0854	23.7722	22.9886	24.2487	24.9011	28.5281	31.2688	35.6008	(46)

Water storage loss:

Store volume 143.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)

Temperature factor from Table 2b 0.6000 (49)

Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	261.7183	230.9934	243.9209	210.5691	201.5501	178.7855	174.2383	182.6387	186.3116	211.1678	228.7626	258.3196	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	261.7183	230.9934	243.9209	210.5691	201.5501	178.7855	174.2383	182.6387	186.3116	211.1678	228.7626	258.3196	(64)

Total per year (kWh/year) = Sum(64)m = 2568.9758 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	96.8299	85.6646	90.9122	79.5063	76.8239	68.9383	67.7428	70.5359	71.4407	80.0218	85.5557	95.6998	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	138.5497	138.5497	138.5497	138.5497	138.5497	138.5497	138.5497	138.5497	138.5497	138.5497	138.5497	138.5497	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	24.8981	22.1143	17.9845	13.6154	10.1777	8.5924	9.2844	12.0683	16.1980	20.5671	24.0048	25.5901	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	303.6518	306.8028	298.8625	281.9585	260.6203	240.5654	227.1674	224.0165	231.9568	248.8608	270.1990	290.2539	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.1641	51.1641	51.1641	51.1641	51.1641	51.1641	51.1641	51.1641	51.1641	51.1641	51.1641	51.1641	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-92.3665	-92.3665	-92.3665	-92.3665	-92.3665	-92.3665	-92.3665	-92.3665	-92.3665	-92.3665	-92.3665	-92.3665	(71)
Water heating gains (Table 5)													
	130.1477	127.4771	122.1938	110.4255	103.2580	95.7476	91.0521	94.8063	99.2232	107.5562	118.8273	128.6287	(72)
Total internal gains													
	556.0450	553.7415	536.3882	503.3468	471.4033	442.2528	424.8514	428.2384	444.7254	474.3314	510.3785	541.8201	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	8.9800	33.4622	0.6300	0.8270	0.7700	108.4952	(79)

Solar gains	108.4952	197.2459	282.0494	367.6072	407.5818	393.2668	383.8588	342.0835	302.6649	216.6924	133.5514	94.9532	(83)
Total gains	664.5402	750.9875	818.4376	870.9540	878.9851	835.5196	808.7102	770.3219	747.3903	691.0239	643.9299	636.7733	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	123.0034	123.0034	124.2768	128.2603	128.9492	131.7803	133.2430	133.2430	130.3494	126.9044	125.5769	126.2372	
alpha	9.2002	9.2002	9.2851	9.5507	9.5966	9.7854	9.8829	9.8829	9.6900	9.4603	9.3718	9.4158	
util living area													
	0.8076	0.7152	0.6057	0.4708	0.3649	0.2845	0.2273	0.2426	0.3380	0.5170	0.7061	0.8263	(86)
MIT	20.9551	20.9831	20.9960	20.9997	21.0000	21.0000	21.0000	21.0000	21.0000	20.9993	20.9878	20.9496	(87)
Th 2	20.5675	20.5675	20.5718	20.5846	20.5867	20.5953	20.5996	20.5996	20.5910	20.5803	20.5761	20.5782	(88)
util rest of house													
	0.7917	0.6984	0.5893	0.4559	0.3503	0.2697	0.2124	0.2269	0.3212	0.4979	0.6870	0.8113	(89)
MIT 2	20.5196	20.5499	20.5678	20.5843	20.5867	20.5953	20.5996	20.5996	20.5910	20.5797	20.5639	20.5239	(90)
Living area fraction										fLA = Living area / (4) =		0.4044	(91)
MIT	20.6957	20.7251	20.7410	20.7523	20.7539	20.7590	20.7615	20.7615	20.7564	20.7494	20.7353	20.6961	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6957	20.7251	20.7410	20.7523	20.7539	20.7590	20.7615	20.7615	20.7564	20.7494	20.7353	20.6961	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7965	0.7046	0.5958	0.4619	0.3562	0.2757	0.2185	0.2333	0.3280	0.5056	0.6942	0.8155	(94)
Useful gains	529.3136	529.1101	487.6030	402.2768	313.1006	230.3536	176.6648	179.6787	245.1244	349.3851	447.0256	519.3073	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	548.3589	536.2592	489.2684	402.4126	313.1106	230.3542	176.6648	179.6788	245.1277	349.6598	452.0438	540.6855	(97)
Space heating kWh													
	14.1697	4.8042	1.2391	0.0978	0.0075	0.0000	0.0000	0.0000	0.0000	0.2044	3.6131	15.9054	(98a)
Space heating requirement - total per year (kWh/year)												40.0411	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	14.1697	4.8042	1.2391	0.0978	0.0075	0.0000	0.0000	0.0000	0.0000	0.2044	3.6131	15.9054	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												40.0411	
Space heating per m2										(98c) / (4) =		0.5510	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	14.1697	4.8042	1.2391	0.0978	0.0075	0.0000	0.0000	0.0000	0.0000	0.2044	3.6131	15.9054	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	14.1697	4.8042	1.2391	0.0978	0.0075	0.0000	0.0000	0.0000	0.0000	0.2044	3.6131	15.9054	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	261.7183	230.9934	243.9209	210.5691	201.5501	178.7855	174.2383	182.6387	186.3116	211.1678	228.7626	258.3196	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	261.7183	230.9934	243.9209	210.5691	201.5501	178.7855	174.2383	182.6387	186.3116	211.1678	228.7626	258.3196	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.4091	12.1114	13.4091	12.9765	13.4091	12.9765	13.4091	13.4091	12.9765	13.4091	12.9765	13.4091	(231)

Lighting	21.7931	17.4833	15.7417	11.5331	8.9085	7.2783	8.1266	10.5633	13.7207	18.0022	20.3335	22.3988	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.4927	-26.0911	-44.0819	-57.9357	-67.5927	-63.7489	-63.2652	-55.8699	-45.3674	-31.9465	-18.3555	-13.3269	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.0763	-7.8610	-18.4870	-33.0482	-45.7062	-45.2285	-45.3086	-35.1482	-23.7144	-11.7764	-4.4543	-2.4433	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	40.0411	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2568.9758	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	157.8811	(230a)
Total electricity for the above, kWh/year	157.8811	(231)
Electricity for lighting (calculated in Appendix L)	175.8832	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-779.3268	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2163.4544	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	40.0411	25.1600	10.0743	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2568.9758	25.1600	646.3543	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	157.8811	25.1600	39.7229	(249)
Energy for lighting	175.8832	25.1600	44.2522	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-503.0743	25.1600	-126.5735	
PV Unit electricity exported	-276.2524	5.8100	-16.0503	
Total			-142.6238	(252)
Total energy cost			597.7800	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	40.0411	0.1611	6.4488	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2568.9758	0.1413	363.0032	(264)
Space and water heating			369.4521	(265)
Pumps, fans and electric keep-hot	157.8811	0.1387	21.9001	(267)
Energy for lighting	175.8832	0.1443	25.3854	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-503.0743	0.1320	-66.4047	
PV Unit electricity exported	-276.2524	0.1230	-33.9835	
Total			-100.3882	(269)
Total CO2, kg/year			316.3493	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	40.0411	1.5960	63.9054	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2568.9758	1.5225	3911.2817	(278)
Space and water heating			3975.1872	(279)
Pumps, fans and electric keep-hot	157.8811	1.5128	238.8425	(281)
Energy for lighting	175.8832	1.5338	269.7755	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-503.0743	1.4877	-748.4241	
PV Unit electricity exported	-276.2524	0.4515	-124.7191	
Total			-873.1432	(283)
Total Primary energy kWh/year			3610.6619	(286)

SAP 10 EPC IMPROVEMENTS

Unit 128 L06_Copy

Current energy efficiency rating: B 81
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: B 81
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£740	£740	£0
Space heating	£50	£50	£0
Water heating	£646	£646	£0
Lighting	£44	£44	£0
Generated (PV)	-£143	-£143	£0
Total cost of fuels	£597	£597	£0
Total cost of uses	£597	£597	£0
Delivered energy	30 kWh/m²	30 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	4 kg/m²	4 kg/m²	0 kg/m²
Primary energy	50 kWh/m²	50 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	72.6700	(1b)	x 2.4000	(2b) =	174.4080	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.6700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		174.4080	(5)

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2. Ventilation rate

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	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			8.9800	1.2357	11.0970			(27)
External Wall 1	22.8100	8.9800	13.8300	0.1400	1.9362	14.0000	193.6200	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	13.0332			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			72.6700			80.0000	5813.6000	(32d)
Party Ceiling 1			72.6700			80.0000	5813.6000	(32b)
Internal Wall 1			139.0500			9.0000	1251.4500	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14457.2700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		198.9441 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.8600	0.0500	0.1930
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.9000	0.0700	1.1830
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	51.3000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		2.8600 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	15.8932 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.5883	16.4211	16.2538	15.4174	15.2502	14.4138	14.4138	14.2466	14.7484	15.2502	15.5847	15.9193	(38)
Heat transfer coeff	32.4815	32.3142	32.1469	31.3106	31.1433	30.3070	30.3070	30.1397	30.6415	31.1433	31.4779	31.8124	(39)
Average = Sum(39)m / 12 =												31.2688	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4470	0.4447	0.4424	0.4309	0.4286	0.4170	0.4170	0.4147	0.4217	0.4286	0.4332	0.4378	(40)
HLP (average)												0.4303	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.3092 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
86.5380	85.2375	83.3424	79.7165	77.0407	74.0567	72.3605	74.2413	76.3029	79.5069	83.2106	86.2064	(42a)

Hot water usage for baths

27.1881	26.7843	26.2157	25.1673	24.3822	23.5118	23.0416	23.6062	24.2210	25.1524	26.2224	27.0962	(42b)

Hot water usage for other uses

38.2781	36.8862	35.4943	34.1023	32.7104	31.3185	31.3185	32.7104	34.1023	35.4943	36.8862	38.2781	(42c)

Average daily hot water use (litres/day)		139.7911 (43)

Daily hot water use

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
152.0042	148.9080	145.0524	138.9861	134.1333	128.8869	126.7206	130.5579	134.6262	140.1535	146.3193	151.5807	(44)
Energy conte 240.7375	212.0430	222.9401	190.2651	180.5693	158.4815	153.2575	161.6579	166.0076	190.1870	208.4586	237.3388	(45)

Energy content (annual)	Total = Sum(45)m =	2321.9438

Distribution loss (46)m = 0.15 x (45)m

36.1106	31.8064	33.4410	28.5398	27.0854	23.7722	22.9886	24.2487	24.9011	28.5281	31.2688	35.6008	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

261.7183	230.9934	243.9209	210.5691	201.5501	178.7855	174.2383	182.6387	186.3116	211.1678	228.7626	258.3196	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

261.7183	230.9934	243.9209	210.5691	201.5501	178.7855	174.2383	182.6387	186.3116	211.1678	228.7626	258.3196	(64)

	Total per year (kWh/year) = Sum(64)m =	2568.9758 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000 (64a)

Heat gains from water heating, kWh/month

96.8299	85.6646	90.9122	79.5063	76.8239	68.9383	67.7428	70.5359	71.4407	80.0218	85.5557	95.6998	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	138.5497	138.5497	138.5497	138.5497	138.5497	138.5497	138.5497	138.5497	138.5497	138.5497	138.5497	138.5497	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	24.8981	22.1143	17.9845	13.6154	10.1777	8.5924	9.2844	12.0683	16.1980	20.5671	24.0048	25.5901	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	303.6518	306.8028	298.8625	281.9585	260.6203	240.5654	227.1674	224.0165	231.9568	248.8608	270.1990	290.2539	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.1641	51.1641	51.1641	51.1641	51.1641	51.1641	51.1641	51.1641	51.1641	51.1641	51.1641	51.1641	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-92.3665	-92.3665	-92.3665	-92.3665	-92.3665	-92.3665	-92.3665	-92.3665	-92.3665	-92.3665	-92.3665	-92.3665	(71)
Water heating gains (Table 5)													
	130.1477	127.4771	122.1938	110.4255	103.2580	95.7476	91.0521	94.8063	99.2232	107.5562	118.8273	128.6287	(72)
Total internal gains													
	556.0450	553.7415	536.3882	503.3468	471.4033	442.2528	424.8514	428.2384	444.7254	474.3314	510.3785	541.8201	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	8.9800	36.7938	0.6300	0.8270	0.7700	119.2973	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	119.2973	203.2075	278.0373	344.5017	385.8706	383.0802	369.3302	338.4671	301.0556	224.5875	142.8907	102.0936	(83)
Total gains	675.3423	756.9490	814.4255	847.8485	857.2739	825.3330	794.1816	766.7056	745.7810	698.9190	653.2692	643.9138	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	123.6368	124.2768	124.9235	128.2603	128.9492	132.5076	132.5076	133.2430	131.0609	128.9492	127.5788	126.2372	
alpha	9.2425	9.2851	9.3282	9.5507	9.5966	9.8338	9.8338	9.8829	9.7374	9.5966	9.5053	9.4158	
util living area	0.7799	0.6806	0.5710	0.4467	0.3378	0.2350	0.1679	0.1808	0.2835	0.4633	0.6648	0.8015	(86)
MIT	20.9673	20.9894	20.9977	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9998	20.9932	20.9618	(87)
Th 2	20.5697	20.5718	20.5739	20.5846	20.5867	20.5974	20.5974	20.5996	20.5932	20.5867	20.5825	20.5782	(88)
util rest of house	0.7633	0.6636	0.5545	0.4314	0.3228	0.2202	0.1525	0.1651	0.2668	0.4449	0.6458	0.7855	(89)
MIT 2	20.5351	20.5609	20.5717	20.5844	20.5867	20.5974	20.5974	20.5996	20.5932	20.5866	20.5758	20.5376	(90)
Living area fraction										fLA = Living area / (4) =		0.4044	(91)
MIT	20.7099	20.7342	20.7440	20.7524	20.7539	20.7603	20.7603	20.7615	20.7577	20.7537	20.7446	20.7091	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7099	20.7342	20.7440	20.7524	20.7539	20.7603	20.7603	20.7615	20.7577	20.7537	20.7446	20.7091	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7688	0.6701	0.5611	0.4376	0.3289	0.2262	0.1588	0.1715	0.2735	0.4523	0.6532	0.7906	(94)
Useful gains	519.1886	507.2217	456.9671	371.0283	281.9633	186.6986	126.0847	131.4552	204.0016	316.1335	426.7379	509.0512	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	533.0183	511.6701	457.9011	371.1064	281.9677	186.6987	126.0847	131.4552	204.0021	316.2192	429.5039	525.1957	(97)
Space heating kWh	10.2893	2.9894	0.6949	0.0562	0.0033	0.0000	0.0000	0.0000	0.0000	0.0638	1.9916	12.0115	(98a)
Space heating requirement - total per year (kWh/year)												28.0999	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	10.2893	2.9894	0.6949	0.0562	0.0033	0.0000	0.0000	0.0000	0.0000	0.0638	1.9916	12.0115	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												28.0999	
Space heating per m2											(98c) / (4) =	0.3867	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	10.2893	2.9894	0.6949	0.0562	0.0033	0.0000	0.0000	0.0000	0.0000	0.0638	1.9916	12.0115	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	10.2893	2.9894	0.6949	0.0562	0.0033	0.0000	0.0000	0.0000	0.0000	0.0638	1.9916	12.0115	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	261.7183	230.9934	243.9209	210.5691	201.5501	178.7855	174.2383	182.6387	186.3116	211.1678	228.7626	258.3196	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	261.7183	230.9934	243.9209	210.5691	201.5501	178.7855	174.2383	182.6387	186.3116	211.1678	228.7626	258.3196	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.4091	12.1114	13.4091	12.9765	13.4091	12.9765	13.4091	13.4091	12.9765	13.4091	12.9765	13.4091	(231)
Lighting	21.7931	17.4833	15.7417	11.5331	8.9085	7.2783	8.1266	10.5633	13.7207	18.0022	20.3335	22.3988	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-17.0948	-27.1131	-44.0860	-55.5994	-65.3077	-62.8415	-61.8427	-55.8530	-45.6671	-33.3416	-19.7403	-14.4153	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.6234	-8.4043	-18.5044	-30.6656	-42.8411	-44.0091	-43.3839	-35.1285	-23.9968	-12.6734	-5.0306	-2.7847	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												28.0999	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2568.9758	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	157.8811	(230a)
Total electricity for the above, kWh/year	157.8811	(231)
Electricity for lighting (calculated in Appendix L)	175.8832	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-773.9484	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2156.8915	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	28.0999	16.4900	4.6337	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2568.9758	16.4900	423.6241	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	157.8811	16.4900	26.0346	(249)
Energy for lighting	175.8832	16.4900	29.0031	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-502.9026	16.4900	-82.9286	
PV Unit electricity exported	-271.0458	5.5900	-15.1515	
Total			-98.0801	(252)
Total energy cost			385.2154	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1785	(257)
SAP value		80.8960	
SAP rating (Section 12)		81	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	28.0999	0.1615	4.5375	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2568.9758	0.1413	363.0032	(264)
Space and water heating			367.5407	(265)
Pumps, fans and electric keep-hot	157.8811	0.1387	21.9001	(267)
Energy for lighting	175.8832	0.1443	25.3854	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-502.9026	0.1323	-66.5384	
PV Unit electricity exported	-271.0458	0.1235	-33.4742	
Total			-100.0126	(269)
Total CO2, kg/year			314.8136	(272)
CO2 emissions per m2			4.3300	(273)
EI value			96.4150	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		72.6700 (1b)	x	2.4000 (2b)	=	174.4080	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.6700						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	174.4080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			8.9800	1.2357	11.0970			(27)
External Wall 1	22.8100	8.9800	13.8300	0.1400	1.9362	14.0000	193.6200	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	13.0332			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			72.6700			80.0000	5813.6000	(32d)
Party Ceiling 1			72.6700			80.0000	5813.6000	(32b)
Internal Wall 1			139.0500			9.0000	1251.4500	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 14457.2700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.9441 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.8600	0.0500	0.1930
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.9000	0.0700	1.1830
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	51.3000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	2.8600 (36)
Point Thermal bridges	(36a) = 0.0000
Total fabric heat loss	(33) + (36) + (36a) = 15.8932 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.7556	16.7556	16.4211	15.4174	15.2502	14.5811	14.2466	14.2466	14.9156	15.7520	16.0865	15.9193	(38)
Heat transfer coeff	32.6488	32.6488	32.3142	31.3106	31.1433	30.4743	30.1397	30.1397	30.8088	31.6451	31.9797	31.8124	(39)
Average = Sum(39)m / 12 =												31.4221	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4493	0.4493	0.4447	0.4309	0.4286	0.4194	0.4147	0.4147	0.4240	0.4355	0.4401	0.4378	(40)
HLP (average)												0.4324	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3092 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
86.5380	85.2375	83.3424	79.7165	77.0407	74.0567	72.3605	74.2413	76.3029	79.5069	83.2106	86.2064	(42a)

Hot water usage for baths

27.1881	26.7843	26.2157	25.1673	24.3822	23.5118	23.0416	23.6062	24.2210	25.1524	26.2224	27.0962	(42b)

Hot water usage for other uses

38.2781	36.8862	35.4943	34.1023	32.7104	31.3185	31.3185	32.7104	34.1023	35.4943	36.8862	38.2781	(42c)

Average daily hot water use (litres/day)	139.7911 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	152.0042	148.9080	145.0524	138.9861	134.1333	128.8869	126.7206	130.5579	134.6262	140.1535	146.3193	151.5807	(44)
Energy conte	240.7375	212.0430	222.9401	190.2651	180.5693	158.4815	153.2575	161.6579	166.0076	190.1870	208.4586	237.3388	(45)
Energy content (annual)										Total = Sum(45)m =		2321.9438	
Distribution loss (46)m = 0.15 x (45)m	36.1106	31.8064	33.4410	28.5398	27.0854	23.7722	22.9886	24.2487	24.9011	28.5281	31.2688	35.6008	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

261.7183	230.9934	243.9209	210.5691	201.5501	178.7855	174.2383	182.6387	186.3116	211.1678	228.7626	258.3196	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	261.7183	230.9934	243.9209	210.5691	201.5501	178.7855	174.2383	182.6387	186.3116	211.1678	228.7626	258.3196	(64)
									Total per year (kWh/year) = Sum(64)m =			2568.9758	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	96.8299	85.6646	90.9122	79.5063	76.8239	68.9383	67.7428	70.5359	71.4407	80.0218	85.5557	95.6998	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	138.5497	138.5497	138.5497	138.5497	138.5497	138.5497	138.5497	138.5497	138.5497	138.5497	138.5497	138.5497	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.8981	22.1143	17.9845	13.6154	10.1777	8.5924	9.2844	12.0683	16.1980	20.5671	24.0048	25.5901	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	303.6518	306.8028	298.8625	281.9585	260.6203	240.5654	227.1674	224.0165	231.9568	248.8608	270.1990	290.2539	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.1641	51.1641	51.1641	51.1641	51.1641	51.1641	51.1641	51.1641	51.1641	51.1641	51.1641	51.1641	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-92.3665	-92.3665	-92.3665	-92.3665	-92.3665	-92.3665	-92.3665	-92.3665	-92.3665	-92.3665	-92.3665	-92.3665	(71)
Water heating gains (Table 5)	130.1477	127.4771	122.1938	110.4255	103.2580	95.7476	91.0521	94.8063	99.2232	107.5562	118.8273	128.6287	(72)
Total internal gains	556.0450	553.7415	536.3882	503.3468	471.4033	442.2528	424.8514	428.2384	444.7254	474.3314	510.3785	541.8201	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	8.9800	33.4622	0.6300	0.8270	0.7700	108.4952	(79)

Solar gains	108.4952	197.2459	282.0494	367.6072	407.5818	393.2668	383.8588	342.0835	302.6649	216.6924	133.5514	94.9532	(83)
Total gains	664.5402	750.9875	818.4376	870.9540	878.9851	835.5196	808.7102	770.3219	747.3903	691.0239	643.9299	636.7733	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	123.0034	123.0034	124.2768	128.2603	128.9492	131.7803	133.2430	133.2430	130.3494	126.9044	125.5769	126.2372	
alpha	9.2002	9.2002	9.2851	9.5507	9.5966	9.7854	9.8829	9.8829	9.6900	9.4603	9.3718	9.4158	
util living area	0.8076	0.7152	0.6057	0.4708	0.3649	0.2845	0.2273	0.2426	0.3380	0.5170	0.7061	0.8263	(86)
MIT	20.9551	20.9831	20.9960	20.9997	21.0000	21.0000	21.0000	21.0000	21.0000	20.9993	20.9878	20.9496	(87)
Th 2	20.5675	20.5675	20.5718	20.5846	20.5867	20.5953	20.5996	20.5996	20.5910	20.5803	20.5761	20.5782	(88)
util rest of house	0.7917	0.6984	0.5893	0.4559	0.3503	0.2697	0.2124	0.2269	0.3212	0.4979	0.6870	0.8113	(89)
MIT 2	20.5196	20.5499	20.5678	20.5843	20.5867	20.5953	20.5996	20.5996	20.5910	20.5797	20.5639	20.5239	(90)
Living area fraction										fLA = Living area / (4) =		0.4044	(91)
MIT	20.6957	20.7251	20.7410	20.7523	20.7539	20.7590	20.7615	20.7615	20.7564	20.7494	20.7353	20.6961	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6957	20.7251	20.7410	20.7523	20.7539	20.7590	20.7615	20.7615	20.7564	20.7494	20.7353	20.6961	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7965	0.7046	0.5958	0.4619	0.3562	0.2757	0.2185	0.2333	0.3280	0.5056	0.6942	0.8155	(94)
Useful gains	529.3136	529.1101	487.6030	402.2768	313.1006	230.3536	176.6648	179.6787	245.1244	349.3851	447.0256	519.3073	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	548.3589	536.2592	489.2684	402.4126	313.1106	230.3542	176.6648	179.6788	245.1277	349.6598	452.0438	540.6855	(97)
Space heating kWh	14.1697	4.8042	1.2391	0.0978	0.0075	0.0000	0.0000	0.0000	0.0000	0.2044	3.6131	15.9054	(98a)
Space heating requirement - total per year (kWh/year)												40.0411	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	14.1697	4.8042	1.2391	0.0978	0.0075	0.0000	0.0000	0.0000	0.0000	0.2044	3.6131	15.9054	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												40.0411	
Space heating per m2											(98c) / (4) =	0.5510	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	14.1697	4.8042	1.2391	0.0978	0.0075	0.0000	0.0000	0.0000	0.0000	0.2044	3.6131	15.9054	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													

	14.1697	4.8042	1.2391	0.0978	0.0075	0.0000	0.0000	0.0000	0.0000	0.2044	3.6131	15.9054 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	261.7183	230.9934	243.9209	210.5691	201.5501	178.7855	174.2383	182.6387	186.3116	211.1678	228.7626	258.3196 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	261.7183	230.9934	243.9209	210.5691	201.5501	178.7855	174.2383	182.6387	186.3116	211.1678	228.7626	258.3196 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	13.4091	12.1114	13.4091	12.9765	13.4091	12.9765	13.4091	13.4091	12.9765	13.4091	12.9765	13.4091 (231)
Lighting	21.7931	17.4833	15.7417	11.5331	8.9085	7.2783	8.1266	10.5633	13.7207	18.0022	20.3335	22.3988 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-15.4927	-26.0911	-44.0819	-57.9357	-67.5927	-63.7489	-63.2652	-55.8699	-45.3674	-31.9465	-18.3555	-13.3269 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-3.0763	-7.8610	-18.4870	-33.0482	-45.7062	-45.2285	-45.3086	-35.1482	-23.7144	-11.7764	-4.4543	-2.4433 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	40.0411 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2568.9758 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	157.8811 (230a)
Total electricity for the above, kWh/year	157.8811 (231)
Electricity for lighting (calculated in Appendix L)	175.8832 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-779.3268 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2163.4544 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	40.0411	25.1600	10.0743	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2568.9758	25.1600	646.3543	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	157.8811	25.1600	39.7229	(249)
Energy for lighting	175.8832	25.1600	44.2522	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-503.0743	25.1600	-126.5735	
PV Unit electricity exported	-276.2524	5.8100	-16.0503	
Total			-142.6238	(252)
Total energy cost			597.7800	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	40.0411	0.1611	6.4488	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2568.9758	0.1413	363.0032	(264)
Space and water heating			369.4521	(265)
Pumps, fans and electric keep-hot	157.8811	0.1387	21.9001	(267)
Energy for lighting	175.8832	0.1443	25.3854	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-503.0743	0.1320	-66.4047	
PV Unit electricity exported	-276.2524	0.1230	-33.9835	
Total			-100.3882	(269)
Total CO2, kg/year			316.3493	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	40.0411	1.5960	63.9054	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2568.9758	1.5225	3911.2817	(278)
Space and water heating			3975.1872	(279)

Pumps, fans and electric keep-hot	157.8811	1.5128	238.8425 (281)
Energy for lighting	175.8832	1.5338	269.7755 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-503.0743	1.4877	-748.4241
PV Unit electricity exported	-276.2524	0.4515	-124.7191
Total			-873.1432 (283)
Total Primary energy kWh/year			3610.6619 (286)

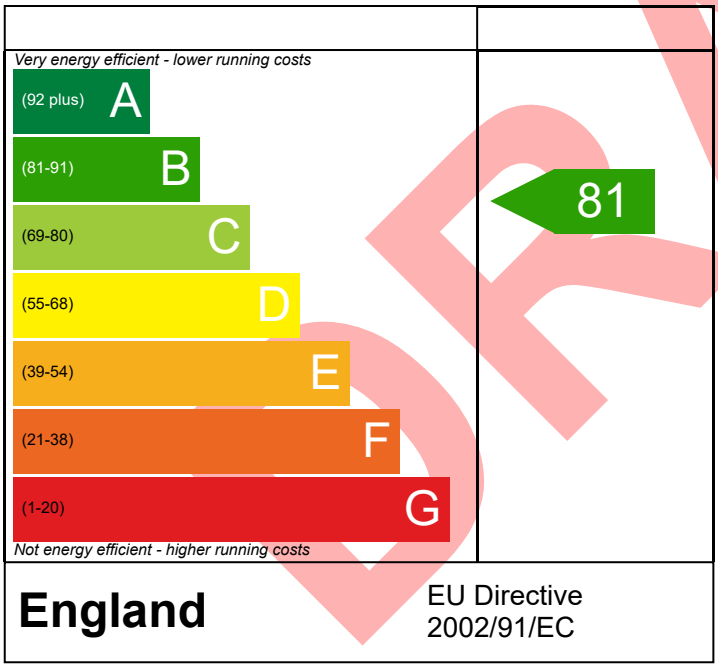
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	72.67 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

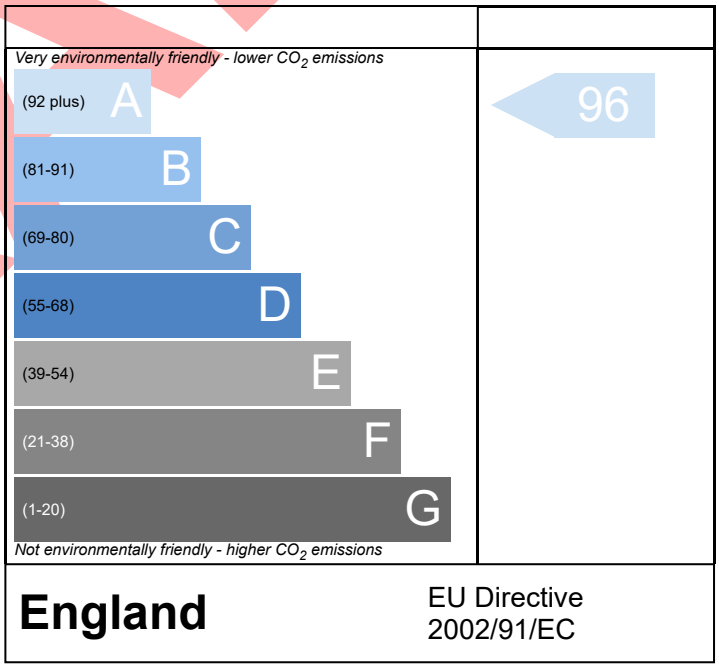
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:23

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	64 m^2
Site Reference	Unit 156 L05_Copy	Plot Reference	Unit 156 L05_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*12.3 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	6.25 kgCO_2/m^2	**OK**
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*66.47 kWh$_{PE}$/m^2*	
Dwelling primary energy	68.78 kWh$_{PE}$/m^2	**FAIL**
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*25.8 kWh/m^2*	
Dwelling fabric energy efficiency	28.7 kWh/m^2	**FAIL**

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	**OK**
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	**OK**
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	21.07	0.14 **(!)**
Party wall: Party Wall (1)	37.53	0 **(!)**
Party wall: Party Wall (2)	6.68	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	7.88	North East	0.83	1.3
N, Opening Type 1	2.11	North	0.83	1.3
NW, Opening Type 1	11.81	North West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.82 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 156 L05_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 156 L05_Copy	**Prop Type Ref**	Unit 156 L05
Property			

SAP Rating	76 C	**DER**	6.25	**TER**	12.30
Environmental	95 A	**% DER < TER**			49.19
CO_2 Emissions (t/year)	0.4	**DFEE**	28.70	**TFEE**	25.80
Compliance Check	See BREL	**% DFEE < TFEE**			-11.22
% DPER < TPER	-3.48	**DPER**	68.78	**TPER**	66.47

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.6600 (1b)	x	2.4000 (2b)	=	152.7840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.6600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	152.7840	(5)

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2. Ventilation rate
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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			21.8000	1.2357	26.9392			(27)
External Wall 1	42.8700	21.8000	21.0700	0.1400	2.9498	14.0000	294.9800	(29a)
Total net area of external elements Aum(A, m2)			42.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.8890			(33)
Party Wall 1			37.5300	0.0000	0.0000	20.0000	750.6000	(32)
Wall to corridor			6.6800	0.0000	0.0000	20.0000	133.6000	(32)
Party Floor 1			63.6600			80.0000	5092.8000	(32d)
Party Ceiling 1			63.6600			80.0000	5092.8000	(32b)
Internal Wall 1			123.2200			9.0000	1108.9800	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12473.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		195.9434 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	9.3800	0.0500	0.4690

E4 Jamb	27.8400	0.0500	1.3920	
E7 Party floor between dwellings (in blocks of flats)	15.8700	0.0700	1.1109	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3700	0.0000	0.0000	
E16 Corner (normal)	5.4000	0.0900	0.4860	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.7819 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 33.6709 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.2548	15.0941	14.9334	14.1298	13.9691	13.1656	13.1656	13.0049	13.4870	13.9691	14.2906	14.6120	(38)
Heat transfer coeff	48.9257	48.7650	48.6043	47.8007	47.6400	46.8365	46.8365	46.6757	47.1579	47.6400	47.9614	48.2828	(39)
Average = Sum(39)m / 12 =												47.7605	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7685	0.7660	0.7635	0.7509	0.7484	0.7357	0.7357	0.7332	0.7408	0.7484	0.7534	0.7584	(40)
HLP (average)												0.7502	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0830 (42)

Hot water usage for mixer showers

81.3240	80.1018	78.3209	74.9135	72.3989	69.5946	68.0007	69.7681	71.7056	74.7165	78.1971	81.0124	(42a)

Hot water usage for baths

25.5574	25.1778	24.6433	23.6578	22.9198	22.1016	21.6596	22.1903	22.7682	23.6438	24.6497	25.4710	(42b)

Hot water usage for other uses

35.9620	34.6543	33.3466	32.0389	30.7312	29.4235	29.4235	30.7312	32.0389	33.3466	34.6543	35.9620	(42c)

Average daily hot water use (litres/day) 131.3665 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	142.8434	139.9340	136.3109	130.6102	126.0499	121.1197	119.0838	122.6897	126.5127	131.7069	137.5011	142.4454	(44)
Energy conte	226.2290	199.2641	209.5047	178.7988	169.6874	148.9308	144.0215	151.9154	156.0028	178.7250	195.8955	223.0351	(45)
Energy content (annual)										Total = Sum(45)m =		2182.0102	
Distribution loss (46)m = 0.15 x (45)m	33.9344	29.8896	31.4257	26.8198	25.4531	22.3396	21.6032	22.7873	23.4004	26.8088	29.3843	33.4553	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
									Total per year (kWh/year) = Sum(64)m =		2429.0422	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

92.0058	81.4156	86.4450	75.6938	73.2057	65.7627	64.6718	67.2965	68.1141	76.2107	81.3784	90.9438	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.9586	18.6152	15.1389	11.4611	8.5673	7.2329	7.8154	10.1588	13.6351	17.3128	20.2066	21.5411	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	271.7527	274.5726	267.4664	252.3383	233.2416	215.2935	203.3031	200.4831	207.5893	222.7175	241.8141	259.7622	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	(71)
Water heating gains (Table 5)	123.6637	121.1542	116.1895	105.1303	98.3948	91.3371	86.9244	90.4523	94.6030	102.4338	113.0256	122.2363	(72)
Total internal gains	507.6160	505.5831	490.0359	460.1707	431.4448	405.1046	389.2840	392.3353	407.0684	433.7051	466.2874	494.7806	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1100	10.6334	0.6300	0.8270	0.7700	8.1009	(74)
Northeast	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(75)
Northwest	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(81)

Solar gains	88.3144	178.7581	320.4794	525.3714	706.3245	753.2685	704.5544	561.4605	390.0832	217.9657	110.9228	72.2597	(83)
Total gains	595.9304	684.3412	810.5153	985.5421	1137.7693	1158.3731	1093.8384	953.7958	797.1516	651.6708	577.2102	567.0403	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.8203	71.0537	71.2887	72.4871	72.7316	73.9794	73.9794	74.2341	73.4752	72.7316	72.2442	71.7632	
alpha	5.7214	5.7369	5.7526	5.8325	5.8488	5.9320	5.9320	5.9489	5.8983	5.8488	5.8163	5.7842	
util living area	0.9495	0.9033	0.7864	0.5758	0.3884	0.2587	0.1884	0.2251	0.4070	0.7170	0.9072	0.9584	(86)
MIT	20.4430	20.6297	20.8505	20.9756	20.9976	20.9998	21.0000	20.9999	20.9978	20.9371	20.6818	20.4051	(87)
Th 2	20.2807	20.2829	20.2851	20.2961	20.2983	20.3094	20.3094	20.3116	20.3050	20.2983	20.2939	20.2895	(88)
util rest of house	0.9400	0.8877	0.7604	0.5448	0.3594	0.2308	0.1588	0.1914	0.3664	0.6785	0.8895	0.9504	(89)
MIT 2	19.6501	19.8768	20.1321	20.2738	20.2964	20.3093	20.3094	20.3116	20.3035	20.2415	19.9531	19.6111	(90)
Living area fraction										fLA = Living area / (4) =		0.3699	(91)
MIT	19.9434	20.1553	20.3979	20.5334	20.5558	20.5647	20.5649	20.5662	20.5604	20.4988	20.2227	19.9048	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9434	20.1553	20.3979	20.5334	20.5558	20.5647	20.5649	20.5662	20.5604	20.4988	20.2227	19.9048	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9350	0.8847	0.7647	0.5553	0.3701	0.2411	0.1698	0.2039	0.3814	0.6898	0.8875	0.9454	(94)
Useful gains	557.2083	605.4138	619.7693	547.3032	421.0875	279.3214	185.6954	194.4496	304.0092	449.5203	512.2933	536.1066	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	765.3659	743.9254	675.4971	556.0856	421.8901	279.3673	185.6996	194.4617	304.6569	471.5806	629.3813	758.2722	(97)
Space heating kWh	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(98a)
Space heating requirement - total per year (kWh/year)												562.3385	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												562.3385	
Space heating per m2										(98c) / (4) =		8.8335	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.0817	10.0092	11.0817	10.7242	11.0817	10.7242	11.0817	11.0817	10.7242	11.0817	10.7242	11.0817	(231)
Lighting	18.3449	14.7170	13.2510	9.7083	7.4989	6.1267	6.8408	8.8919	11.5497	15.1538	17.1162	18.8548	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.3302	-24.3862	-39.3596	-49.2100	-57.7415	-55.5822	-54.6983	-49.3462	-40.2733	-29.5092	-17.6479	-12.9166	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.7432	-6.5971	-15.2405	-26.0425	-36.6010	-37.6280	-37.0950	-30.0206	-20.4973	-10.6316	-3.9607	-2.0877	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	562.3385	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2429.0422	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	130.4775	(230a)
Total electricity for the above, kWh/year	130.4775	(231)
Electricity for lighting (calculated in Appendix L)	148.0540	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-675.1465	(233)
Wind generation	0.0000	(234)

Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2594.7657	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	562.3385	16.4900	92.7296	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	16.4900	400.5491	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	130.4775	16.4900	21.5157	(249)
Energy for lighting	148.0540	16.4900	24.4141	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.0013	16.4900	-73.5456	
PV Unit electricity exported	-229.1452	5.5900	-12.8092	
Total			-86.3548	(252)
Total energy cost			452.8537	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.5003	(257)
SAP value	75.6794	
SAP rating (Section 12)	76	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	562.3385	0.1589	89.3676	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2429.0422	0.1413	343.1917	(264)
Space and water heating			432.5592	(265)
Pumps, fans and electric keep-hot	130.4775	0.1387	18.0988	(267)
Energy for lighting	148.0540	0.1443	21.3688	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.0013	0.1324	-59.0465	
PV Unit electricity exported	-229.1452	0.1229	-28.1599	
Total			-87.2065	(269)
Total CO2, kg/year			384.8203	(272)
CO2 emissions per m2			6.0400	(273)
EI value			95.2544	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.6600 (1b)	x	2.4000 (2b)	=	152.7840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 63.6600						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	152.7840	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			21.8000	1.2357	26.9392			(27)
External Wall 1	42.8700	21.8000	21.0700	0.1400	2.9498	14.0000	294.9800	(29a)
Total net area of external elements Aum(A, m2)			42.8700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.8890			(33)
Party Wall 1			37.5300	0.0000	0.0000	20.0000	750.6000	(32)
Wall to corridor			6.6800	0.0000	0.0000	20.0000	133.6000	(32)
Party Floor 1			63.6600			80.0000	5092.8000	(32d)
Party Ceiling 1			63.6600			80.0000	5092.8000	(32b)
Internal Wall 1			123.2200			9.0000	1108.9800	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12473.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 195.9434 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	9.3800	0.0500	0.4690
E4 Jamb	27.8400	0.0500	1.3920
E7 Party floor between dwellings (in blocks of flats)	15.8700	0.0700	1.1109
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3700	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.7819 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 33.6709 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.4155	15.4155	15.0941	14.1298	13.9691	13.3263	13.0049	13.0049	13.6477	14.4513	14.7727	14.6120	(38)
Heat transfer coeff	49.0864	49.0864	48.7650	47.8007	47.6400	46.9972	46.6757	46.6757	47.3186	48.1221	48.4435	48.2828	(39)
Average = Sum(39)m / 12 =												47.9078	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7711	0.7711	0.7660	0.7509	0.7484	0.7383	0.7332	0.7332	0.7433	0.7559	0.7610	0.7584	(40)
HLP (average)												0.7526	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0830 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	81.3240	80.1018	78.3209	74.9135	72.3989	69.5946	68.0007	69.7681	71.7056	74.7165	78.1971	81.0124	(42a)
Hot water usage for baths	25.5574	25.1778	24.6433	23.6578	22.9198	22.1016	21.6596	22.1903	22.7682	23.6438	24.6497	25.4710	(42b)
Hot water usage for other uses	35.9620	34.6543	33.3466	32.0389	30.7312	29.4235	29.4235	30.7312	32.0389	33.3466	34.6543	35.9620	(42c)
Average daily hot water use (litres/day)												131.3665	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	142.8434	139.9340	136.3109	130.6102	126.0499	121.1197	119.0838	122.6897	126.5127	131.7069	137.5011	142.4454	(44)
Energy conte	226.2290	199.2641	209.5047	178.7988	169.6874	148.9308	144.0215	151.9154	156.0028	178.7250	195.8955	223.0351	(45)
Energy content (annual)										Total = Sum(45)m =		2182.0102	
Distribution loss (46)m = 0.15 x (45)m	33.9344	29.8896	31.4257	26.8198	25.4531	22.3396	21.6032	22.7873	23.4004	26.8088	29.3843	33.4553	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
									Total per year (kWh/year) = Sum(64)m =			2429.0422	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	92.0058	81.4156	86.4450	75.6938	73.2057	65.7627	64.6718	67.2965	68.1141	76.2107	81.3784	90.9438	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	20.9586	18.6152	15.1389	11.4611	8.5673	7.2329	7.8154	10.1588	13.6351	17.3128	20.2066	21.5411	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	271.7527	274.5726	267.4664	252.3383	233.2416	215.2935	203.3031	200.4831	207.5893	222.7175	241.8141	259.7622	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	(71)

Water heating gains (Table 5)

	123.6637	121.1542	116.1895	105.1303	98.3948	91.3371	86.9244	90.4523	94.6030	102.4338	113.0256	122.2363	(72)

Total internal gains

	507.6160	505.5831	490.0359	460.1707	431.4448	405.1046	389.2840	392.3353	407.0684	433.7051	466.2874	494.7806	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1100	9.5462	0.6300	0.8270	0.7700	7.2726	(74)
Northeast	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(75)
Northwest	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(81)

Solar gains	78.5852	169.1438	316.2472	546.8143	731.2676	760.0483	718.8368	554.5515	381.6735	204.7435	101.3144	65.8401	(83)
Total gains	586.2012	674.7269	806.2830	1006.9851	1162.7125	1165.1528	1108.1208	946.8868	788.7419	638.4486	567.6018	560.6207	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.5885	70.5885	71.0537	72.4871	72.7316	73.7264	74.2341	74.2341	73.2256	72.0029	71.5252	71.7632	
alpha	5.7059	5.7059	5.7369	5.8325	5.8488	5.9151	5.9489	5.9489	5.8817	5.8002	5.7683	5.7842	
util living area	0.9573	0.9201	0.8197	0.6065	0.4204	0.3144	0.2569	0.3054	0.4881	0.7768	0.9246	0.9649	(86)
MIT	20.3836	20.5593	20.8002	20.9657	20.9959	20.9994	20.9999	20.9996	20.9932	20.8936	20.6163	20.3459	(87)
Th 2	20.2785	20.2785	20.2829	20.2961	20.2983	20.3072	20.3116	20.3116	20.3027	20.2917	20.2873	20.2895	(88)
util rest of house	0.9492	0.9069	0.7967	0.5771	0.3923	0.2865	0.2279	0.2716	0.4478	0.7427	0.9098	0.9582	(89)
MIT 2	19.5748	19.7882	20.0732	20.2636	20.2949	20.3067	20.3115	20.3114	20.2976	20.1904	19.8693	19.5372	(90)
Living area fraction									fLA = Living area / (4) =			0.3699	(91)
MIT	19.8740	20.0735	20.3421	20.5233	20.5543	20.5630	20.5662	20.5660	20.5549	20.4505	20.1456	19.8364	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8740	20.0735	20.3421	20.5233	20.5543	20.5630	20.5662	20.5660	20.5549	20.4505	20.1456	19.8364	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9440	0.9027	0.7987	0.5867	0.4026	0.2968	0.2386	0.2841	0.4625	0.7507	0.9065	0.9532	(94)
Useful gains	553.3976	609.0788	643.9471	590.8262	468.0629	345.8541	264.4318	269.0226	364.7623	479.2565	514.5178	534.3769	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	784.1055	774.2617	718.8998	603.4044	469.4566	346.0392	264.4719	269.1309	366.9520	517.3378	656.1978	779.1096	(97)
Space heating kWh	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(98a)
Space heating requirement - total per year (kWh/year)												660.9309	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												660.9309	
Space heating per m2											(98c) / (4) =	10.3822	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
Efficiency of water heater												100.0000	(216)

(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.0817	10.0092	11.0817	10.7242	11.0817	10.7242	11.0817	11.0817	10.7242	11.0817	10.7242	11.0817	(231)
Lighting	18.3449	14.7170	13.2510	9.7083	7.4989	6.1267	6.8408	8.8919	11.5497	15.1538	17.1162	18.8548	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-13.8915	-23.5305	-39.5288	-51.3707	-59.7978	-56.3926	-55.9689	-49.3612	-40.0071	-28.3817	-16.4413	-11.9422	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.3070	-6.0873	-15.0525	-27.9982	-39.0374	-38.6728	-38.7444	-30.0375	-20.2557	-9.7595	-3.4566	-1.8147	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	660.9309	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2429.0422	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	130.4775	(230a)
Total electricity for the above, kWh/year	130.4775	(231)
Electricity for lighting (calculated in Appendix L)	148.0540	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-679.8382	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2688.6664	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	660.9309	25.1600	166.2902	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	25.1600	611.1470	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	130.4775	25.1600	32.8281	(249)
Energy for lighting	148.0540	25.1600	37.2504	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.6146	25.1600	-112.3682	
PV Unit electricity exported	-233.2236	5.8100	-13.5503	
Total			-125.9185	(252)
Total energy cost			721.5972	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	660.9309	0.1583	104.6387	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2429.0422	0.1413	343.1917	(264)
Space and water heating			447.8304	(265)
Pumps, fans and electric keep-hot	130.4775	0.1387	18.0988	(267)
Energy for lighting	148.0540	0.1443	21.3688	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.6146	0.1321	-58.9946	
PV Unit electricity exported	-233.2236	0.1224	-28.5364	
Total			-87.5310	(269)
Total CO2, kg/year			399.7670	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	660.9309	1.5860	1048.2442	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	1.5224	3698.0874	(278)
Space and water heating			4746.3316	(279)
Pumps, fans and electric keep-hot	130.4775	1.5128	197.3864	(281)
Energy for lighting	148.0540	1.5338	227.0901	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.6146	1.4881	-664.5888	
PV Unit electricity exported	-233.2236	0.4490	-104.7247	
Total			-769.3135	(283)
Total Primary energy kWh/year			4401.4946	(286)

SAP 10 EPC IMPROVEMENTS

Unit 156 L05_Copy

Current energy efficiency rating: C 76
Current environmental impact rating: A 95

N Solar water heating	Not applicable
U Solar photovoltaic panels	Not applicable
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 76
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£848	£848	£0
Space heating	£199	£199	£0
Water heating	£611	£611	£0
Lighting	£37	£37	£0
Generated (PV)	-£126	-£126	£0
Total cost of fuels	£722	£722	£0
Total cost of uses	£721	£721	£0
Delivered energy	42 kWh/m²	42 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	69 kWh/m²	69 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.6600 (1b)	x	2.4000 (2b)	=	152.7840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.6600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	152.7840	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			21.8000	1.2357	26.9392			(27)
External Wall 1	42.8700	21.8000	21.0700	0.1400	2.9498	14.0000	294.9800	(29a)
Total net area of external elements Aum(A, m2)			42.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.8890			(33)
Party Wall 1			37.5300	0.0000	0.0000	20.0000	750.6000	(32)
Wall to corridor			6.6800	0.0000	0.0000	20.0000	133.6000	(32)
Party Floor 1			63.6600			80.0000	5092.8000	(32d)
Party Ceiling 1			63.6600			80.0000	5092.8000	(32b)
Internal Wall 1			123.2200			9.0000	1108.9800	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12473.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 195.9434 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	9.3800	0.0500	0.4690
E4 Jamb	27.8400	0.0500	1.3920
E7 Party floor between dwellings (in blocks of flats)	15.8700	0.0700	1.1109
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3700	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.7819 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 33.6709 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.2548	15.0941	14.9334	14.1298	13.9691	13.1656	13.1656	13.0049	13.4870	13.9691	14.2906	14.6120	(38)
Heat transfer coeff	48.9257	48.7650	48.6043	47.8007	47.6400	46.8365	46.8365	46.6757	47.1579	47.6400	47.9614	48.2828	(39)

Average = Sum(39)m / 12 = 47.7605

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7685	0.7660	0.7635	0.7509	0.7484	0.7357	0.7357	0.7332	0.7408	0.7484	0.7534	0.7584	(40)
HLP (average)												0.7502	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0830 (42)
Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
81.3240	80.1018	78.3209	74.9135	72.3989	69.5946	68.0007	69.7681	71.7056	74.7165	78.1971	81.0124	(42a)

Hot water usage for baths

25.5574	25.1778	24.6433	23.6578	22.9198	22.1016	21.6596	22.1903	22.7682	23.6438	24.6497	25.4710	(42b)

Hot water usage for other uses

35.9620	34.6543	33.3466	32.0389	30.7312	29.4235	29.4235	30.7312	32.0389	33.3466	34.6543	35.9620	(42c)

Average daily hot water use (litres/day) 131.3665 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	142.8434	139.9340	136.3109	130.6102	126.0499	121.1197	119.0838	122.6897	126.5127	131.7069	137.5011	142.4454	(44)
Energy conte	226.2290	199.2641	209.5047	178.7988	169.6874	148.9308	144.0215	151.9154	156.0028	178.7250	195.8955	223.0351	(45)
Energy content (annual)										Total = Sum(45)m =		2182.0102	
Distribution loss (46)m = 0.15 x (45)m	33.9344	29.8896	31.4257	26.8198	25.4531	22.3396	21.6032	22.7873	23.4004	26.8088	29.3843	33.4553	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
										Total per year (kWh/year) = Sum(64)m =		2429.0422	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	92.0058	81.4156	86.4450	75.6938	73.2057	65.7627	64.6718	67.2965	68.1141	76.2107	81.3784	90.9438	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.9586	18.6152	15.1389	11.4611	8.5673	7.2329	7.8154	10.1588	13.6351	17.3128	20.2066	21.5411	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	271.7527	274.5726	267.4664	252.3383	233.2416	215.2935	203.3031	200.4831	207.5893	222.7175	241.8141	259.7622	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	(71)
Water heating gains (Table 5)	123.6637	121.1542	116.1895	105.1303	98.3948	91.3371	86.9244	90.4523	94.6030	102.4338	113.0256	122.2363	(72)

Total internal gains

	507.6160	505.5831	490.0359	460.1707	431.4448	405.1046	389.2840	392.3353	407.0684	433.7051	466.2874	494.7806 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1100	10.6334	0.6300	0.8270	0.7700	8.1009	(74)
Northeast	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(75)
Northwest	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(81)

Solar gains	88.3144	178.7581	320.4794	525.3714	706.3245	753.2685	704.5544	561.4605	390.0832	217.9657	110.9228	72.2597 (83)
Total gains	595.9304	684.3412	810.5153	985.5421	1137.7693	1158.3731	1093.8384	953.7958	797.1516	651.6708	577.2102	567.0403 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.8203	71.0537	71.2887	72.4871	72.7316	73.9794	73.9794	74.2341	73.4752	72.7316	72.2442	71.7632	
alpha	5.7214	5.7369	5.7526	5.8325	5.8488	5.9320	5.9320	5.9489	5.8983	5.8488	5.8163	5.7842	
util living area	0.9495	0.9033	0.7864	0.5758	0.3884	0.2587	0.1884	0.2251	0.4070	0.7170	0.9072	0.9584	(86)
MIT	20.4430	20.6297	20.8505	20.9756	20.9976	20.9998	21.0000	20.9999	20.9978	20.9371	20.6818	20.4051	(87)
Th 2	20.2807	20.2829	20.2851	20.2961	20.2983	20.3094	20.3094	20.3116	20.3050	20.2983	20.2939	20.2895	(88)
util rest of house	0.9400	0.8877	0.7604	0.5448	0.3594	0.2308	0.1588	0.1914	0.3664	0.6785	0.8895	0.9504	(89)
MIT 2	19.6501	19.8768	20.1321	20.2738	20.2964	20.3093	20.3094	20.3116	20.3035	20.2415	19.9531	19.6111	(90)
Living area fraction									fLA = Living area / (4) =			0.3699	(91)
MIT	19.9434	20.1553	20.3979	20.5334	20.5558	20.5647	20.5649	20.5662	20.5604	20.4988	20.2227	19.9048	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9434	20.1553	20.3979	20.5334	20.5558	20.5647	20.5649	20.5662	20.5604	20.4988	20.2227	19.9048	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9350	0.8847	0.7647	0.5553	0.3701	0.2411	0.1698	0.2039	0.3814	0.6898	0.8875	0.9454	(94)
Useful gains	557.2083	605.4138	619.7693	547.3032	421.0875	279.3214	185.6954	194.4496	304.0092	449.5203	512.2933	536.1066	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	765.3659	743.9254	675.4971	556.0856	421.8901	279.3673	185.6996	194.4617	304.6569	471.5806	629.3813	758.2722	(97)
Space heating kWh	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(98a)
Space heating requirement - total per year (kWh/year)												562.3385	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												562.3385	
Space heating per m2											(98c) / (4) =	8.8335	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.0817	10.0092	11.0817	10.7242	11.0817	10.7242	11.0817	11.0817	10.7242	11.0817	10.7242	11.0817	(231)
Lighting	18.3449	14.7170	13.2510	9.7083	7.4989	6.1267	6.8408	8.8919	11.5497	15.1538	17.1162	18.8548	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.3302	-24.3862	-39.3596	-49.2100	-57.7415	-55.5822	-54.6983	-49.3462	-40.2733	-29.5092	-17.6479	-12.9166	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													

(233b)m	-2.7432	-6.5971	-15.2405	-26.0425	-36.6010	-37.6280	-37.0950	-30.0206	-20.4973	-10.6316	-3.9607	-2.0877	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	562.3385	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2429.0422	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	130.4775	(230a)
Total electricity for the above, kWh/year	130.4775	(231)
Electricity for lighting (calculated in Appendix L)	148.0540	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-675.1465	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2594.7657	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	562.3385	16.4900	92.7296	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	16.4900	400.5491	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	130.4775	16.4900	21.5157	(249)
Energy for lighting	148.0540	16.4900	24.4141	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.0013	16.4900	-73.5456	
PV Unit electricity exported	-229.1452	5.5900	-12.8092	
Total			-86.3548	(252)
Total energy cost			452.8537	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.5003	(257)
SAP value		75.6794	
SAP rating (Section 12)		76	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	562.3385	0.1589	89.3676	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2429.0422	0.1413	343.1917	(264)
Space and water heating			432.5592	(265)
Pumps, fans and electric keep-hot	130.4775	0.1387	18.0988	(267)
Energy for lighting	148.0540	0.1443	21.3688	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.0013	0.1324	-59.0465	
PV Unit electricity exported	-229.1452	0.1229	-28.1599	
Total			-87.2065	(269)
Total CO2, kg/year			384.8203	(272)
CO2 emissions per m2			6.0400	(273)
EI value			95.2544	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		63.6600 (1b)	x	2.4000 (2b)	=	152.7840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.6600						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	152.7840	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			21.8000	1.2357	26.9392			(27)
External Wall 1	42.8700	21.8000	21.0700	0.1400	2.9498	14.0000	294.9800	(29a)
Total net area of external elements Aum(A, m2)			42.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.8890			(33)
Party Wall 1			37.5300	0.0000	0.0000	20.0000	750.6000	(32)
Wall to corridor			6.6800	0.0000	0.0000	20.0000	133.6000	(32)
Party Floor 1			63.6600			80.0000	5092.8000	(32d)
Party Ceiling 1			63.6600			80.0000	5092.8000	(32b)
Internal Wall 1			123.2200			9.0000	1108.9800	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12473.7600	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	195.9434	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	9.3800	0.0500	0.4690
E4 Jamb	27.8400	0.0500	1.3920
E7 Party floor between dwellings (in blocks of flats)	15.8700	0.0700	1.1109
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3700	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	3.7819	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	33.6709	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.4155	15.4155	15.0941	14.1298	13.9691	13.3263	13.0049	13.0049	13.6477	14.4513	14.7727	14.6120	(38)
Heat transfer coeff	49.0864	49.0864	48.7650	47.8007	47.6400	46.9972	46.6757	46.6757	47.3186	48.1221	48.4435	48.2828	(39)
Average = Sum(39)m / 12 =												47.9078	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7711	0.7711	0.7660	0.7509	0.7484	0.7383	0.7332	0.7332	0.7433	0.7559	0.7610	0.7584	(40)
HLP (average)												0.7526	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0830	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
81.3240	80.1018	78.3209	74.9135	72.3989	69.5946	68.0007	69.7681	71.7056	74.7165	78.1971	81.0124	(42a)

Hot water usage for baths

25.5574	25.1778	24.6433	23.6578	22.9198	22.1016	21.6596	22.1903	22.7682	23.6438	24.6497	25.4710	(42b)

Hot water usage for other uses

35.9620	34.6543	33.3466	32.0389	30.7312	29.4235	29.4235	30.7312	32.0389	33.3466	34.6543	35.9620	(42c)

Average daily hot water use (litres/day)	131.3665	(43)

Daily hot water use

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
142.8434	139.9340	136.3109	130.6102	126.0499	121.1197	119.0838	122.6897	126.5127	131.7069	137.5011	142.4454	(44)
Energy conte 226.2290	199.2641	209.5047	178.7988	169.6874	148.9308	144.0215	151.9154	156.0028	178.7250	195.8955	223.0351	(45)
Energy content (annual)										Total = Sum(45)m =		2182.0102	

Distribution loss (46)m = 0.15 x (45)m

33.9344	29.8896	31.4257	26.8198	25.4531	22.3396	21.6032	22.7873	23.4004	26.8088	29.3843	33.4553	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

Total storage loss													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
											Total per year (kWh/year) = Sum(64)m =	2429.0422	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000	(64a)
Heat gains from water heating, kWh/month													
	92.0058	81.4156	86.4450	75.6938	73.2057	65.7627	64.6718	67.2965	68.1141	76.2107	81.3784	90.9438	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.9586	18.6152	15.1389	11.4611	8.5673	7.2329	7.8154	10.1588	13.6351	17.3128	20.2066	21.5411	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	271.7527	274.5726	267.4664	252.3383	233.2416	215.2935	203.3031	200.4831	207.5893	222.7175	241.8141	259.7622	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	(71)
Water heating gains (Table 5)													
	123.6637	121.1542	116.1895	105.1303	98.3948	91.3371	86.9244	90.4523	94.6030	102.4338	113.0256	122.2363	(72)
Total internal gains													
	507.6160	505.5831	490.0359	460.1707	431.4448	405.1046	389.2840	392.3353	407.0684	433.7051	466.2874	494.7806	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1100	9.5462	0.6300	0.8270	0.7700	7.2726	(74)
Northeast	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(75)
Northwest	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(81)

Solar gains	78.5852	169.1438	316.2472	546.8143	731.2676	760.0483	718.8368	554.5515	381.6735	204.7435	101.3144	65.8401	(83)
Total gains	586.2012	674.7269	806.2830	1006.9851	1162.7125	1165.1528	1108.1208	946.8868	788.7419	638.4486	567.6018	560.6207	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.5885	70.5885	71.0537	72.4871	72.7316	73.7264	74.2341	74.2341	73.2256	72.0029	71.5252	71.7632	
alpha	5.7059	5.7059	5.7369	5.8325	5.8488	5.9151	5.9489	5.9489	5.8817	5.8002	5.7683	5.7842	
util living area													
	0.9573	0.9201	0.8197	0.6065	0.4204	0.3144	0.2569	0.3054	0.4881	0.7768	0.9246	0.9649	(86)
MIT	20.3836	20.5593	20.8002	20.9657	20.9959	20.9994	20.9999	20.9996	20.9932	20.8936	20.6163	20.3459	(87)
Th 2	20.2785	20.2785	20.2829	20.2961	20.2983	20.3072	20.3116	20.3116	20.3027	20.2917	20.2873	20.2895	(88)
util rest of house													
	0.9492	0.9069	0.7967	0.5771	0.3923	0.2865	0.2279	0.2716	0.4478	0.7427	0.9098	0.9582	(89)
MIT 2	19.5748	19.7882	20.0732	20.2636	20.2949	20.3067	20.3115	20.3114	20.2976	20.1904	19.8693	19.5372	(90)
Living area fraction										fLA = Living area / (4) =		0.3699	(91)
MIT	19.8740	20.0735	20.3421	20.5233	20.5543	20.5630	20.5662	20.5660	20.5549	20.4505	20.1456	19.8364	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8740	20.0735	20.3421	20.5233	20.5543	20.5630	20.5662	20.5660	20.5549	20.4505	20.1456	19.8364	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9440	0.9027	0.7987	0.5867	0.4026	0.2968	0.2386	0.2841	0.4625	0.7507	0.9065	0.9532	(94)
Useful gains	553.3976	609.0788	643.9471	590.8262	468.0629	345.8541	264.4318	269.0226	364.7623	479.2565	514.5178	534.3769	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	784.1055	774.2617	718.8998	603.4044	469.4566	346.0392	264.4719	269.1309	366.9520	517.3378	656.1978	779.1096	(97)
Space heating kWh													
	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(98a)
Space heating requirement - total per year (kWh/year)												660.9309	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												660.9309	
Space heating per m2											(98c) / (4) =	10.3822	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.0817	10.0092	11.0817	10.7242	11.0817	10.7242	11.0817	11.0817	10.7242	11.0817	10.7242	11.0817	(231)
Lighting	18.3449	14.7170	13.2510	9.7083	7.4989	6.1267	6.8408	8.8919	11.5497	15.1538	17.1162	18.8548	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-13.8915	-23.5305	-39.5288	-51.3707	-59.7978	-56.3926	-55.9689	-49.3612	-40.0071	-28.3817	-16.4413	-11.9422	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.3070	-6.0873	-15.0525	-27.9982	-39.0374	-38.6728	-38.7444	-30.0375	-20.2557	-9.7595	-3.4566	-1.8147	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												660.9309	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2429.0422	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)													
mechanical ventilation fans (SFP = 0.7000)												130.4775	(230a)
Total electricity for the above, kWh/year												130.4775	(231)
Electricity for lighting (calculated in Appendix L)												148.0540	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-679.8382	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2688.6664	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	660.9309	25.1600	166.2902	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	25.1600	611.1470	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	130.4775	25.1600	32.8281	(249)
Energy for lighting	148.0540	25.1600	37.2504	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.6146	25.1600	-112.3682	
PV Unit electricity exported	-233.2236	5.8100	-13.5503	
Total			-125.9185	(252)
Total energy cost			721.5972	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	660.9309	0.1583	104.6387	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2429.0422	0.1413	343.1917	(264)
Space and water heating			447.8304	(265)
Pumps, fans and electric keep-hot	130.4775	0.1387	18.0988	(267)
Energy for lighting	148.0540	0.1443	21.3688	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.6146	0.1321	-58.9946	
PV Unit electricity exported	-233.2236	0.1224	-28.5364	
Total			-87.5310	(269)
Total CO2, kg/year			399.7670	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	660.9309	1.5860	1048.2442	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	1.5224	3698.0874	(278)
Space and water heating			4746.3316	(279)
Pumps, fans and electric keep-hot	130.4775	1.5128	197.3864	(281)
Energy for lighting	148.0540	1.5338	227.0901	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.6146	1.4881	-664.5888	
PV Unit electricity exported	-233.2236	0.4490	-104.7247	
Total			-769.3135	(283)
Total Primary energy kWh/year			4401.4946	(286)

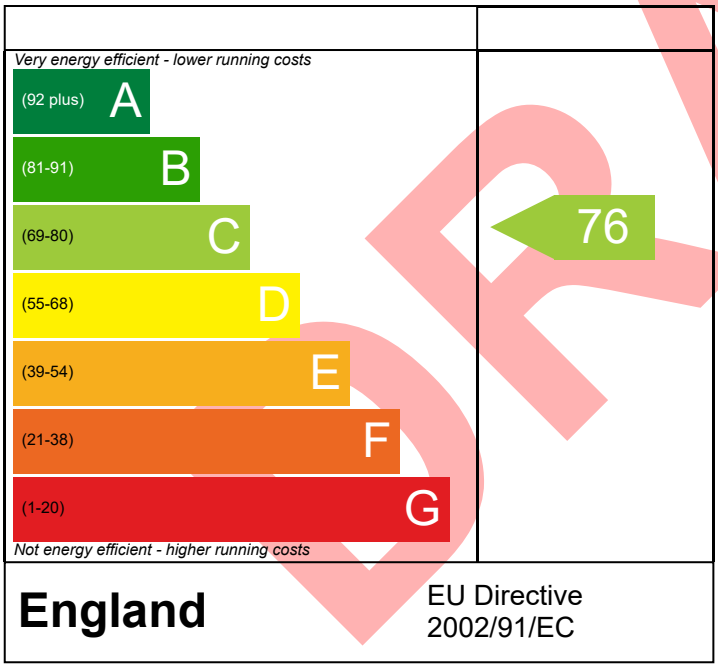
Predicted Energy Assessment

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	63.66 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

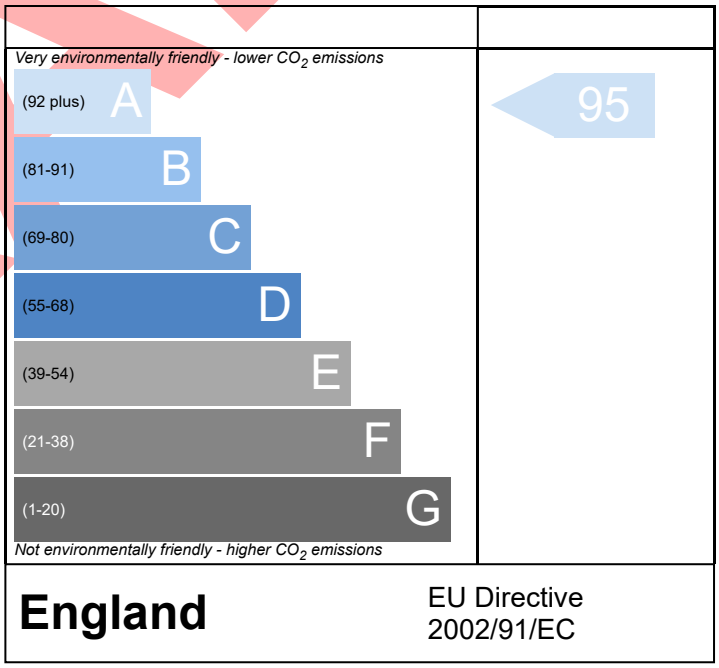
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:23

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	72 m^2
Site Reference	Unit 157 L05_Copy	Plot Reference	Unit 157 L05_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*10.45 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	4.68 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*56.41 kWh_{PE}/m^2*	
Dwelling primary energy	52.87 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*18.9 kWh/m^2*	
Dwelling fabric energy efficiency	17.8 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	16.81	0.14 **(!)**
Party wall: Party Wall (1)	41.71	0 **(!)**
Party wall: Party Wall (2)	22.81	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	11.81	North East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.93 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 157 L05_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 157 L05_Copy	**Prop Type Ref**	Unit 157 L05
Property			

SAP Rating	80 C	**DER**	4.68	**TER**	10.45
Environmental	96 A	**% DER < TER**			55.22
CO_2 Emissions (t/year)	0.33	**DFEE**	17.78	**TFEE**	18.90
Compliance Check	See BREL	**% DFEE < TFEE**			5.90
% DPER < TPER	6.27	**DPER**	52.87	**TPER**	56.41

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	71.6800	(1b)	x 2.4000	(2b) =	172.0320	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.6800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	172.0320	(5)

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2. Ventilation rate
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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	28.6200	11.8100	16.8100	0.1400	2.3534	14.0000	235.3400	(29a)
Total net area of external elements Aum(A, m2)			28.6200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.9475			(33)
Party Wall 1			41.7100	0.0000	0.0000	20.0000	834.2000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			71.6800			80.0000	5734.4000	(32d)
Party Ceiling 1			71.6800			80.0000	5734.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14231.4100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		198.5409 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545

E4 Jamb	13.9200	0.0500	0.6960	
E7 Party floor between dwellings (in blocks of flats)	10.6000	0.0700	0.7420	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.9000	0.0000	0.0000	
E16 Corner (normal)	2.7000	0.0900	0.2430	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.2595 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 19.2070 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3623	16.1974	16.0324	15.2074	15.0424	14.2175	14.2175	14.0525	14.5475	15.0424	15.3724	15.7024	(38)
Heat transfer coeff	35.5693	35.4044	35.2394	34.4144	34.2494	33.4245	33.4245	33.2595	33.7545	34.2494	34.5794	34.9094	(39)
Average = Sum(39)m / 12 =												34.3732	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4962	0.4939	0.4916	0.4801	0.4778	0.4663	0.4663	0.4640	0.4709	0.4778	0.4824	0.4870	(40)
HLP (average)												0.4795	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2862 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	86.0089	84.7163	82.8328	79.2291	76.5696	73.6038	71.9181	73.7873	75.8363	79.0207	82.7018	85.6793	(42a)
Hot water usage for baths	27.0226	26.6213	26.0561	25.0141	24.2338	23.3686	22.9013	23.4625	24.0735	24.9993	26.0628	26.9312	(42b)
Hot water usage for other uses	38.0431	36.6597	35.2763	33.8929	32.5095	31.1262	31.1262	32.5095	33.8929	35.2763	36.6597	38.0431	(42c)
Average daily hot water use (litres/day)												138.9361	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.0745	147.9973	144.1652	138.1361	133.3130	128.0986	125.9455	129.7594	133.8028	139.2963	145.4243	150.6536	(44)
Energy conte	239.2651	210.7461	221.5766	189.1014	179.4649	157.5122	152.3202	160.6692	164.9922	189.0238	207.1836	235.8872	(45)
Energy content (annual)										Total = Sum(45)m =		2307.7426	
Distribution loss (46)m = 0.15 x (45)m	35.8898	31.6119	33.2365	28.3652	26.9197	23.6268	22.8480	24.1004	24.7488	28.3536	31.0775	35.3831	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)
										Total per year (kWh/year) = Sum(64)m =		2554.7746	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	96.3403	85.2334	90.4589	79.1194	76.4567	68.6160	67.4311	70.2071	71.1031	79.6351	85.1318	95.2171	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.3930	20.7775	16.8974	12.7924	9.5625	8.0730	8.7232	11.3387	15.2188	19.3238	22.5537	24.0432	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	300.2774	303.3934	295.5413	278.8252	257.7241	237.8920	224.6430	221.5270	229.3791	246.0952	267.1963	287.0284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	(71)
Water heating gains (Table 5)	129.4896	126.8354	121.5845	109.8881	102.7644	95.3000	90.6332	94.3644	98.7543	107.0364	118.2386	127.9800	(72)
Total internal gains	549.8877	547.7339	530.7508	498.2333	466.7786	437.9927	420.7271	423.9579	440.0799	469.1831	504.7163	535.7792	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(75)

Solar gains	48.1118	97.9329	176.4440	289.7718	389.5101	415.2590	388.4663	309.6898	214.9998	119.6818	60.5371	39.2905	(83)
Total gains	597.9995	645.6669	707.1948	788.0051	856.2887	853.2517	809.1933	733.6477	655.0797	588.8649	565.2534	575.0697	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	111.1398	111.6577	112.1805	114.8696	115.4229	118.2717	118.2717	118.8584	117.1155	115.4229	114.3215	113.2409	
alpha	8.4093	8.4438	8.4787	8.6580	8.6949	8.8848	8.8848	8.9239	8.8077	8.6949	8.6214	8.5494	
util living area													
	0.8907	0.8306	0.7092	0.5274	0.3719	0.2507	0.1817	0.2085	0.3555	0.6018	0.8105	0.9039	(86)
MIT	20.8722	20.9298	20.9803	20.9984	20.9999	21.0000	21.0000	21.0000	21.0000	20.9963	20.9530	20.8608	(87)
Th 2	20.5243	20.5264	20.5285	20.5391	20.5412	20.5518	20.5518	20.5539	20.5476	20.5412	20.5370	20.5327	(88)
util rest of house													
	0.8771	0.8135	0.6886	0.5076	0.3536	0.2332	0.1632	0.1883	0.3322	0.5761	0.7902	0.8914	(89)
MIT 2	20.3839	20.4516	20.5087	20.5376	20.5412	20.5518	20.5518	20.5539	20.5476	20.5379	20.4887	20.3786	(90)
Living area fraction										fLA = Living area / (4) =		0.4021	(91)
MIT	20.5802	20.6438	20.6983	20.7228	20.7256	20.7320	20.7320	20.7333	20.7295	20.7222	20.6754	20.5725	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5802	20.6438	20.6983	20.7228	20.7256	20.7320	20.7320	20.7333	20.7295	20.7222	20.6754	20.5725	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8788	0.8178	0.6961	0.5155	0.3610	0.2402	0.1707	0.1964	0.3416	0.5863	0.7964	0.8925	(94)
Useful gains	525.5185	528.0545	492.2508	406.2317	309.0939	204.9590	138.1105	144.1228	223.7621	345.2470	450.1599	513.2582	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	579.0763	557.4003	500.3404	406.8764	309.1219	204.9594	138.1105	144.1229	223.7735	346.6793	469.4288	571.5536	(97)
Space heating kWh	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(98a)
Space heating requirement - total per year (kWh/year)												124.3821	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												124.3821	
Space heating per m2											(98c) / (4) =	1.7352	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.2264	11.9464	13.2264	12.7997	13.2264	12.7997	13.2264	13.2264	12.7997	13.2264	12.7997	13.2264	(231)
Lighting	20.4758	16.4264	14.7902	10.8359	8.3700	6.8383	7.6354	9.9247	12.8912	16.9140	19.1043	21.0448	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-17.0008	-26.9528	-43.7049	-55.0326	-64.6365	-62.1981	-61.2076	-55.2744	-45.1885	-33.0016	-19.5873	-14.3353	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.4971	-8.1867	-18.2196	-30.3147	-42.3617	-43.5158	-42.8995	-34.7392	-23.7344	-12.5240	-4.9201	-2.6818	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												124.3821	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2554.7746	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)													
mechanical ventilation fans (SFP = 0.7420)												155.7302	(230a)
Total electricity for the above, kWh/year												155.7302	(231)
Electricity for lighting (calculated in Appendix L)												165.2510	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-765.7149	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)

Appendix Q - special features

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2234.4231	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	124.3821	16.4900	20.5106	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	16.4900	421.2823	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	155.7302	16.4900	25.6799	(249)
Energy for lighting	165.2510	16.4900	27.2499	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.1204	16.4900	-82.1401	
PV Unit electricity exported	-267.5945	5.5900	-14.9585	
Total			-97.0986	(252)
Total energy cost			397.6242	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2268	(257)
SAP value	80.1133	
SAP rating (Section 12)	80	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	124.3821	0.1604	19.9497	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2554.7746	0.1413	360.9927	(264)
Space and water heating			380.9424	(265)
Pumps, fans and electric keep-hot	155.7302	0.1387	21.6017	(267)
Energy for lighting	165.2510	0.1443	23.8508	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.1204	0.1323	-65.9162	
PV Unit electricity exported	-267.5945	0.1234	-33.0212	
Total			-98.9374	(269)
Total CO2, kg/year			327.4575	(272)
CO2 emissions per m2			4.5700	(273)
EI value			96.2393	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	71.6800	(1b)	x 2.4000	(2b) =	172.0320	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 71.6800						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		172.0320	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 = 0.0000	(6a)
Number of open flues	0 * 20 = 0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000	(6d)
Number of flues attached to other heater	0 * 35 = 0.0000	(6e)
Number of blocked chimneys	0 * 20 = 0.0000	(6f)
Number of intermittent extract fans	0 * 10 = 0.0000	(7a)
Number of passive vents	0 * 10 = 0.0000	(7b)
Number of flueless gas fires	0 * 40 = 0.0000	(7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000	(8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	3.0000	(17)
Infiltration rate	0.1500	(18)
Number of sides sheltered	3	(19)
Shelter factor (20) = 1 - [0.075 x (19)] =	0.7750	(20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	28.6200	11.8100	16.8100	0.1400	2.3534	14.0000	235.3400	(29a)
Total net area of external elements Aum(A, m2)			28.6200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.9475			(33)
Party Wall 1			41.7100	0.0000	0.0000	20.0000	834.2000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			71.6800			80.0000	5734.4000	(32d)
Party Ceiling 1			71.6800			80.0000	5734.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14231.4100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 198.5409 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	10.6000	0.0700	0.7420
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.9000	0.0000	0.0000
E16 Corner (normal)	2.7000	0.0900	0.2430

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 0.2595 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 19.2070 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.5273	16.5273	16.1974	15.2074	15.0424	14.3825	14.0525	14.0525	14.7124	15.5374	15.8674	15.7024	(38)
Heat transfer coeff	35.7343	35.7343	35.4044	34.4144	34.2494	33.5895	33.2595	33.2595	33.9195	34.7444	35.0744	34.9094	(39)

Average = Sum(39)m / 12 = 34.5244

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4985	0.4985	0.4939	0.4801	0.4778	0.4686	0.4640	0.4640	0.4732	0.4847	0.4893	0.4870	(40)
HLP (average)												0.4816	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2862 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	86.0089	84.7163	82.8328	79.2291	76.5696	73.6038	71.9181	73.7873	75.8363	79.0207	82.7018	85.6793	(42a)
Hot water usage for baths	27.0226	26.6213	26.0561	25.0141	24.2338	23.3686	22.9013	23.4625	24.0735	24.9993	26.0628	26.9312	(42b)
Hot water usage for other uses	38.0431	36.6597	35.2763	33.8929	32.5095	31.1262	31.1262	32.5095	33.8929	35.2763	36.6597	38.0431	(42c)

Average daily hot water use (litres/day) 138.9361 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.0745	147.9973	144.1652	138.1361	133.3130	128.0986	125.9455	129.7594	133.8028	139.2963	145.4243	150.6536	(44)
Energy conte	239.2651	210.7461	221.5766	189.1014	179.4649	157.5122	152.3202	160.6692	164.9922	189.0238	207.1836	235.8872	(45)

Energy content (annual) Total = Sum(45)m = 2307.7426

Distribution loss (46)m = 0.15 x (45)m	35.8898	31.6119	33.2365	28.3652	26.9197	23.6268	22.8480	24.1004	24.7488	28.3536	31.0775	35.3831	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)

Total per year (kWh/year) = Sum(64)m = 2554.7746 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	96.3403	85.2334	90.4589	79.1194	76.4567	68.6160	67.4311	70.2071	71.1031	79.6351	85.1318	95.2171	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.3930	20.7775	16.8974	12.7924	9.5625	8.0730	8.7232	11.3387	15.2188	19.3238	22.5537	24.0432	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	300.2774	303.3934	295.5413	278.8252	257.7241	237.8920	224.6430	221.5270	229.3791	246.0952	267.1963	287.0284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	(71)
Water heating gains (Table 5)													
	129.4896	126.8354	121.5845	109.8881	102.7644	95.3000	90.6332	94.3644	98.7543	107.0364	118.2386	127.9800	(72)
Total internal gains													
	549.8877	547.7339	530.7508	498.2333	466.7786	437.9927	420.7271	423.9579	440.0799	469.1831	504.7163	535.7792	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(75)

Solar gains	42.7730	92.6022	174.0550	301.5827	403.2921	419.0362	396.3745	305.8819	210.3213	112.3593	55.2465	35.7661	(83)
Total gains	592.6608	640.3361	704.8058	799.8160	870.0707	857.0289	817.1015	729.8397	650.4012	581.5423	559.9628	571.5453	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	110.6266	110.6266	111.6577	114.8696	115.4229	117.6907	118.8584	118.8584	116.5458	113.7786	112.7082	113.2409	
alpha	8.3751	8.3751	8.4438	8.6580	8.6949	8.8460	8.9239	8.9239	8.7697	8.5852	8.5139	8.5494	
util living area													
	0.9065	0.8593	0.7516	0.5619	0.4054	0.3057	0.2483	0.2825	0.4275	0.6674	0.8432	0.9182	(86)
MIT	20.8464	20.9031	20.9677	20.9971	20.9998	21.0000	21.0000	21.0000	20.9998	20.9906	20.9314	20.8348	(87)
Th 2	20.5222	20.5222	20.5264	20.5391	20.5412	20.5497	20.5539	20.5539	20.5455	20.5349	20.5306	20.5327	(88)
util rest of house													
	0.8943	0.8439	0.7321	0.5426	0.3873	0.2881	0.2301	0.2622	0.4039	0.6418	0.8246	0.9073	(89)
MIT 2	20.3514	20.4171	20.4931	20.5364	20.5411	20.5497	20.5539	20.5539	20.5453	20.5262	20.4588	20.3477	(90)
Living area fraction									fLA = Living area / (4) =			0.4021	(91)
MIT	20.5504	20.6125	20.6839	20.7216	20.7255	20.7307	20.7333	20.7333	20.7280	20.7130	20.6488	20.5436	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5504	20.6125	20.6839	20.7216	20.7255	20.7307	20.7333	20.7333	20.7280	20.7130	20.6488	20.5436	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8951	0.8469	0.7387	0.5502	0.3946	0.2951	0.2374	0.2704	0.4134	0.6517	0.8294	0.9075	(94)
Useful gains	530.4783	542.2746	520.6325	440.0970	343.3043	252.9499	194.0117	197.3368	268.8466	378.9737	464.4567	518.6920	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	594.9914	582.9178	534.0374	441.2484	343.3684	252.9535	194.0121	197.3380	268.9149	382.6385	492.7526	587.9989	(97)
Space heating kWh													
	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643	(98a)
Space heating requirement - total per year (kWh/year)												160.8238	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												160.8238	
Space heating per m2										(98c) / (4) =		2.2436	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(219)
Space cooling fuel requirement													

(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.2264	11.9464	13.2264	12.7997	13.2264	12.7997	13.2264	13.2264	12.7997	13.2264	12.7997	13.2264	(231)
Lighting	20.4758	16.4264	14.7902	10.8359	8.3700	6.8383	7.6354	9.9247	12.8912	16.9140	19.1043	21.0448	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.4126	-25.9729	-43.7522	-57.3553	-66.8995	-63.0965	-62.6159	-55.2911	-44.8919	-31.6377	-18.2309	-13.2576	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.9589	-7.6180	-18.1511	-32.6607	-45.1941	-44.7217	-44.8029	-34.7587	-23.4550	-11.6200	-4.3363	-2.3448	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	160.8238	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2554.7746	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	155.7302	(230a)
Total electricity for the above, kWh/year	155.7302	(231)
Electricity for lighting (calculated in Appendix L)	165.2510	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-771.0360	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2265.5437	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	160.8238	25.1600	40.4633	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	25.1600	642.7813	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	155.7302	25.1600	39.1817	(249)
Energy for lighting	165.2510	25.1600	41.5772	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.4140	25.1600	-125.4010	
PV Unit electricity exported	-272.6220	5.8100	-15.8393	
Total			-141.2403	(252)
Total energy cost			622.7632	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	160.8238	0.1598	25.6965	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2554.7746	0.1413	360.9927	(264)
Space and water heating			386.6891	(265)
Pumps, fans and electric keep-hot	155.7302	0.1387	21.6017	(267)
Energy for lighting	165.2510	0.1443	23.8508	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.4140	0.1320	-65.8025	
PV Unit electricity exported	-272.6220	0.1229	-33.5042	
Total			-99.3067	(269)
Total CO2, kg/year			332.8350	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	160.8238	1.5914	255.9292	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	1.5225	3889.6458	(278)
Space and water heating			4145.5750	(279)
Pumps, fans and electric keep-hot	155.7302	1.5128	235.5887	(281)
Energy for lighting	165.2510	1.5338	253.4676	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.4140	1.4878	-741.5395	
PV Unit electricity exported	-272.6220	0.4510	-122.9601	
Total			-864.4997	(283)
Total Primary energy kWh/year			3770.1316	(286)

SAP 10 EPC IMPROVEMENTS

Unit 157 L05_Copy

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 80
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£764	£764	£0
Space heating	£80	£80	£0
Water heating	£643	£643	£0
Lighting	£42	£42	£0
Generated (PV)	-£141	-£141	£0
Total cost of fuels	£623	£623	£0
Total cost of uses	£624	£624	£0
Delivered energy	32 kWh/m²	32 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	53 kWh/m²	53 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	71.6800 (1b)	x	2.4000 (2b)	=	172.0320	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.6800					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	172.0320	(5)

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2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	28.6200	11.8100	16.8100	0.1400	2.3534	14.0000	235.3400	(29a)
Total net area of external elements Aum(A, m2)			28.6200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.9475			(33)
Party Wall 1			41.7100	0.0000	0.0000	20.0000	834.2000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			71.6800			80.0000	5734.4000	(32d)
Party Ceiling 1			71.6800			80.0000	5734.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14231.4100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 198.5409 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	10.6000	0.0700	0.7420
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.9000	0.0000	0.0000
E16 Corner (normal)	2.7000	0.0900	0.2430

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.2595 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 19.2070 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3623	16.1974	16.0324	15.2074	15.0424	14.2175	14.2175	14.0525	14.5475	15.0424	15.3724	15.7024	(38)
Heat transfer coeff	35.5693	35.4044	35.2394	34.4144	34.2494	33.4245	33.4245	33.2595	33.7545	34.2494	34.5794	34.9094	(39)
Average = Sum(39)m / 12 =												34.3732	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4962	0.4939	0.4916	0.4801	0.4778	0.4663	0.4663	0.4640	0.4709	0.4778	0.4824	0.4870	(40)
HLP (average)												0.4795	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2862 (42)
Hot water usage for mixer showers

86.0089	84.7163	82.8328	79.2291	76.5696	73.6038	71.9181	73.7873	75.8363	79.0207	82.7018	85.6793	(42a)

Hot water usage for baths

27.0226	26.6213	26.0561	25.0141	24.2338	23.3686	22.9013	23.4625	24.0735	24.9993	26.0628	26.9312	(42b)

Hot water usage for other uses

38.0431	36.6597	35.2763	33.8929	32.5095	31.1262	31.1262	32.5095	33.8929	35.2763	36.6597	38.0431	(42c)

Average daily hot water use (litres/day) 138.9361 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.0745	147.9973	144.1652	138.1361	133.3130	128.0986	125.9455	129.7594	133.8028	139.2963	145.4243	150.6536	(44)
Energy conte	239.2651	210.7461	221.5766	189.1014	179.4649	157.5122	152.3202	160.6692	164.9922	189.0238	207.1836	235.8872	(45)
Energy content (annual)										Total = Sum(45)m =		2307.7426	
Distribution loss (46)m = 0.15 x (45)m	35.8898	31.6119	33.2365	28.3652	26.9197	23.6268	22.8480	24.1004	24.7488	28.3536	31.0775	35.3831	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)

Total per year (kWh/year) = Sum(64)m = 2554.7746 (64)
Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month

96.3403	85.2334	90.4589	79.1194	76.4567	68.6160	67.4311	70.2071	71.1031	79.6351	85.1318	95.2171	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.3930	20.7775	16.8974	12.7924	9.5625	8.0730	8.7232	11.3387	15.2188	19.3238	22.5537	24.0432	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	300.2774	303.3934	295.5413	278.8252	257.7241	237.8920	224.6430	221.5270	229.3791	246.0952	267.1963	287.0284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	(71)
Water heating gains (Table 5)	129.4896	126.8354	121.5845	109.8881	102.7644	95.3000	90.6332	94.3644	98.7543	107.0364	118.2386	127.9800	(72)
Total internal gains	549.8877	547.7339	530.7508	498.2333	466.7786	437.9927	420.7271	423.9579	440.0799	469.1831	504.7163	535.7792	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(75)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	48.1118	97.9329	176.4440	289.7718	389.5101	415.2590	388.4663	309.6898	214.9998	119.6818	60.5371	39.2905	(83)
Total gains	597.9995	645.6669	707.1948	788.0051	856.2887	853.2517	809.1933	733.6477	655.0797	588.8649	565.2534	575.0697	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	111.1398	111.6577	112.1805	114.8696	115.4229	118.2717	118.2717	118.8584	117.1155	115.4229	114.3215	113.2409	
alpha	8.4093	8.4438	8.4787	8.6580	8.6949	8.8848	8.8848	8.9239	8.8077	8.6949	8.6214	8.5494	
util living area	0.8907	0.8306	0.7092	0.5274	0.3719	0.2507	0.1817	0.2085	0.3555	0.6018	0.8105	0.9039	(86)
MIT	20.8722	20.9298	20.9803	20.9984	20.9999	21.0000	21.0000	21.0000	21.0000	20.9963	20.9530	20.8608	(87)
Th 2	20.5243	20.5264	20.5285	20.5391	20.5412	20.5518	20.5518	20.5539	20.5476	20.5412	20.5370	20.5327	(88)
util rest of house	0.8771	0.8135	0.6886	0.5076	0.3536	0.2332	0.1632	0.1883	0.3322	0.5761	0.7902	0.8914	(89)
MIT 2	20.3839	20.4516	20.5087	20.5376	20.5412	20.5518	20.5518	20.5539	20.5476	20.5379	20.4887	20.3786	(90)
Living area fraction										fLA = Living area / (4) =		0.4021	(91)
MIT	20.5802	20.6438	20.6983	20.7228	20.7256	20.7320	20.7320	20.7333	20.7295	20.7222	20.6754	20.5725	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5802	20.6438	20.6983	20.7228	20.7256	20.7320	20.7320	20.7333	20.7295	20.7222	20.6754	20.5725	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8788	0.8178	0.6961	0.5155	0.3610	0.2402	0.1707	0.1964	0.3416	0.5863	0.7964	0.8925	(94)
Useful gains	525.5185	528.0545	492.2508	406.2317	309.0939	204.9590	138.1105	144.1228	223.7621	345.2470	450.1599	513.2582	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	579.0763	557.4003	500.3404	406.8764	309.1219	204.9594	138.1105	144.1229	223.7735	346.6793	469.4288	571.5536	(97)
Space heating kWh	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(98a)
Space heating requirement - total per year (kWh/year)												124.3821	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												124.3821	
Space heating per m2										(98c) / (4) =		1.7352	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.2264	11.9464	13.2264	12.7997	13.2264	12.7997	13.2264	13.2264	12.7997	13.2264	12.7997	13.2264	(231)
Lighting	20.4758	16.4264	14.7902	10.8359	8.3700	6.8383	7.6354	9.9247	12.8912	16.9140	19.1043	21.0448	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-17.0008	-26.9528	-43.7049	-55.0326	-64.6365	-62.1981	-61.2076	-55.2744	-45.1885	-33.0016	-19.5873	-14.3353	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.4971	-8.1867	-18.2196	-30.3147	-42.3617	-43.5158	-42.8995	-34.7392	-23.7344	-12.5240	-4.9201	-2.6818	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	124.3821	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2554.7746	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	155.7302	(230a)
Total electricity for the above, kWh/year	155.7302	(231)
Electricity for lighting (calculated in Appendix L)	165.2510	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-765.7149	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2234.4231	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	124.3821	16.4900	20.5106	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	16.4900	421.2823	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	155.7302	16.4900	25.6799	(249)
Energy for lighting	165.2510	16.4900	27.2499	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.1204	16.4900	-82.1401	
PV Unit electricity exported	-267.5945	5.5900	-14.9585	
Total			-97.0986	(252)
Total energy cost			397.6242	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2268	(257)
SAP value		80.1133	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	124.3821	0.1604	19.9497	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2554.7746	0.1413	360.9927	(264)
Space and water heating			380.9424	(265)
Pumps, fans and electric keep-hot	155.7302	0.1387	21.6017	(267)
Energy for lighting	165.2510	0.1443	23.8508	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.1204	0.1323	-65.9162	
PV Unit electricity exported	-267.5945	0.1234	-33.0212	
Total			-98.9374	(269)
Total CO2, kg/year			327.4575	(272)
CO2 emissions per m2			4.5700	(273)
EI value			96.2393	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	71.6800	(1b)	x 2.4000	(2b) =	172.0320	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 71.6800						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		172.0320	(5)

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2. Ventilation rate

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m3 per hour

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	28.6200	11.8100	16.8100	0.1400	2.3534	14.0000	235.3400	(29a)
Total net area of external elements Aum(A, m2)			28.6200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.9475			(33)
Party Wall 1			41.7100	0.0000	0.0000	20.0000	834.2000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			71.6800			80.0000	5734.4000	(32d)
Party Ceiling 1			71.6800			80.0000	5734.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14231.4100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		198.5409 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	10.6000	0.0700	0.7420
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.9000	0.0000	0.0000
E16 Corner (normal)	2.7000	0.0900	0.2430

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		2.2595 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	19.2070 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.5273	16.5273	16.1974	15.2074	15.0424	14.3825	14.0525	14.0525	14.7124	15.5374	15.8674	15.7024	(38)
Heat transfer coeff	35.7343	35.7343	35.4044	34.4144	34.2494	33.5895	33.2595	33.2595	33.9195	34.7444	35.0744	34.9094	(39)
Average = Sum(39)m / 12 =												34.5244	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4985	0.4985	0.4939	0.4801	0.4778	0.4686	0.4640	0.4640	0.4732	0.4847	0.4893	0.4870	(40)
HLP (average)												0.4816	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.2862 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
86.0089	84.7163	82.8328	79.2291	76.5696	73.6038	71.9181	73.7873	75.8363	79.0207	82.7018	85.6793	(42a)

Hot water usage for baths

27.0226	26.6213	26.0561	25.0141	24.2338	23.3686	22.9013	23.4625	24.0735	24.9993	26.0628	26.9312	(42b)

Hot water usage for other uses

38.0431	36.6597	35.2763	33.8929	32.5095	31.1262	31.1262	32.5095	33.8929	35.2763	36.6597	38.0431	(42c)

Average daily hot water use (litres/day)	138.9361 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.0745	147.9973	144.1652	138.1361	133.3130	128.0986	125.9455	129.7594	133.8028	139.2963	145.4243	150.6536	(44)
Energy conte	239.2651	210.7461	221.5766	189.1014	179.4649	157.5122	152.3202	160.6692	164.9922	189.0238	207.1836	235.8872	(45)
Energy content (annual)											Total = Sum(45)m =	2307.7426	

Distribution loss (46)m = 0.15 x (45)m

35.8898	31.6119	33.2365	28.3652	26.9197	23.6268	22.8480	24.1004	24.7488	28.3536	31.0775	35.3831	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680 (64)
										Total per year (kWh/year) = Sum(64)m =		2554.7746 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000 (64a)
Heat gains from water heating, kWh/month												
	96.3403	85.2334	90.4589	79.1194	76.4567	68.6160	67.4311	70.2071	71.1031	79.6351	85.1318	95.2171 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.3930	20.7775	16.8974	12.7924	9.5625	8.0730	8.7232	11.3387	15.2188	19.3238	22.5537	24.0432	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	300.2774	303.3934	295.5413	278.8252	257.7241	237.8920	224.6430	221.5270	229.3791	246.0952	267.1963	287.0284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	(71)
Water heating gains (Table 5)													
	129.4896	126.8354	121.5845	109.8881	102.7644	95.3000	90.6332	94.3644	98.7543	107.0364	118.2386	127.9800	(72)
Total internal gains													
	549.8877	547.7339	530.7508	498.2333	466.7786	437.9927	420.7271	423.9579	440.0799	469.1831	504.7163	535.7792	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(75)

Solar gains	42.7730	92.6022	174.0550	301.5827	403.2921	419.0362	396.3745	305.8819	210.3213	112.3593	55.2465	35.7661	(83)
Total gains	592.6608	640.3361	704.8058	799.8160	870.0707	857.0289	817.1015	729.8397	650.4012	581.5423	559.9628	571.5453	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	110.6266	110.6266	111.6577	114.8696	115.4229	117.6907	118.8584	118.8584	116.5458	113.7786	112.7082	113.2409	
alpha	8.3751	8.3751	8.4438	8.6580	8.6949	8.8460	8.9239	8.9239	8.7697	8.5852	8.5139	8.5494	
util living area													
	0.9065	0.8593	0.7516	0.5619	0.4054	0.3057	0.2483	0.2825	0.4275	0.6674	0.8432	0.9182	(86)
MIT	20.8464	20.9031	20.9677	20.9971	20.9998	21.0000	21.0000	21.0000	20.9998	20.9906	20.9314	20.8348	(87)
Th 2	20.5222	20.5222	20.5264	20.5391	20.5412	20.5497	20.5539	20.5539	20.5455	20.5349	20.5306	20.5327	(88)
util rest of house													
	0.8943	0.8439	0.7321	0.5426	0.3873	0.2881	0.2301	0.2622	0.4039	0.6418	0.8246	0.9073	(89)
MIT 2	20.3514	20.4171	20.4931	20.5364	20.5411	20.5497	20.5539	20.5539	20.5453	20.5262	20.4588	20.3477	(90)
Living area fraction										fLA = Living area / (4) =		0.4021	(91)
MIT	20.5504	20.6125	20.6839	20.7216	20.7255	20.7307	20.7333	20.7333	20.7280	20.7130	20.6488	20.5436	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5504	20.6125	20.6839	20.7216	20.7255	20.7307	20.7333	20.7333	20.7280	20.7130	20.6488	20.5436	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8951	0.8469	0.7387	0.5502	0.3946	0.2951	0.2374	0.2704	0.4134	0.6517	0.8294	0.9075	(94)
Useful gains	530.4783	542.2746	520.6325	440.0970	343.3043	252.9499	194.0117	197.3368	268.8466	378.9737	464.4567	518.6920	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	594.9914	582.9178	534.0374	441.2484	343.3684	252.9535	194.0121	197.3380	268.9149	382.6385	492.7526	587.9989	(97)
Space heating kWh													
	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643	(98a)
Space heating requirement - total per year (kWh/year)												160.8238	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												160.8238	
Space heating per m2											(98c) / (4) =	2.2436	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement												

	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643 (98)
Space heating efficiency (main heating system 1)												
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)												
	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	13.2264	11.9464	13.2264	12.7997	13.2264	12.7997	13.2264	13.2264	12.7997	13.2264	12.7997	13.2264 (231)
Lighting	20.4758	16.4264	14.7902	10.8359	8.3700	6.8383	7.6354	9.9247	12.8912	16.9140	19.1043	21.0448 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-15.4126	-25.9729	-43.7522	-57.3553	-66.8995	-63.0965	-62.6159	-55.2911	-44.8919	-31.6377	-18.2309	-13.2576 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.9589	-7.6180	-18.1511	-32.6607	-45.1941	-44.7217	-44.8029	-34.7587	-23.4550	-11.6200	-4.3363	-2.3448 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	160.8238 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2554.7746 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	155.7302 (230a)
Total electricity for the above, kWh/year	155.7302 (231)
Electricity for lighting (calculated in Appendix L)	165.2510 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-771.0360 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2265.5437 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	160.8238	25.1600	40.4633	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	25.1600	642.7813	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	155.7302	25.1600	39.1817	(249)
Energy for lighting	165.2510	25.1600	41.5772	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.4140	25.1600	-125.4010	
PV Unit electricity exported	-272.6220	5.8100	-15.8393	
Total			-141.2403	(252)
Total energy cost			622.7632	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	160.8238	0.1598	25.6965	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2554.7746	0.1413	360.9927	(264)
Space and water heating			386.6891	(265)
Pumps, fans and electric keep-hot	155.7302	0.1387	21.6017	(267)
Energy for lighting	165.2510	0.1443	23.8508	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.4140	0.1320	-65.8025	
PV Unit electricity exported	-272.6220	0.1229	-33.5042	
Total			-99.3067	(269)
Total CO2, kg/year			332.8350	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	

Space heating - main system 1	160.8238	1.5914	255.9292	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	1.5225	3889.6458	(278)
Space and water heating			4145.5750	(279)
Pumps, fans and electric keep-hot	155.7302	1.5128	235.5887	(281)
Energy for lighting	165.2510	1.5338	253.4676	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.4140	1.4878	-741.5395	
PV Unit electricity exported	-272.6220	0.4510	-122.9601	
Total			-864.4997	(283)
Total Primary energy kWh/year			3770.1316	(286)

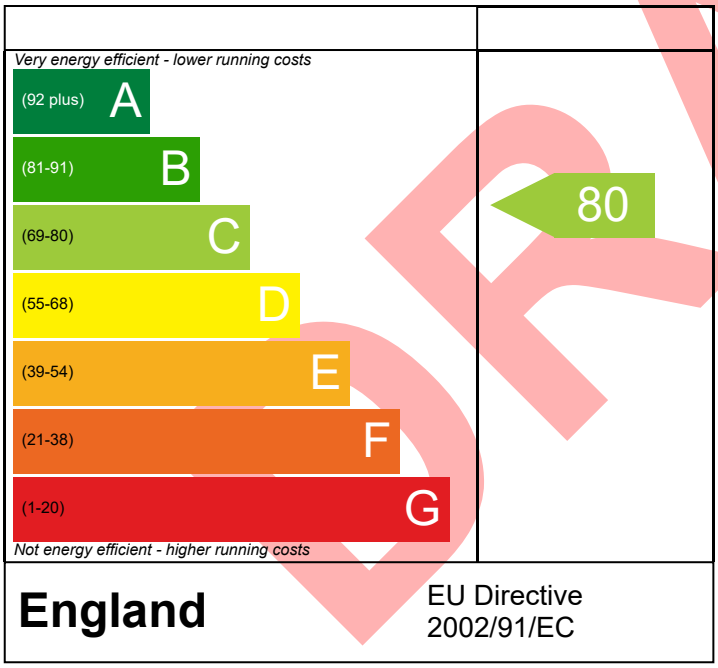
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	71.68 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

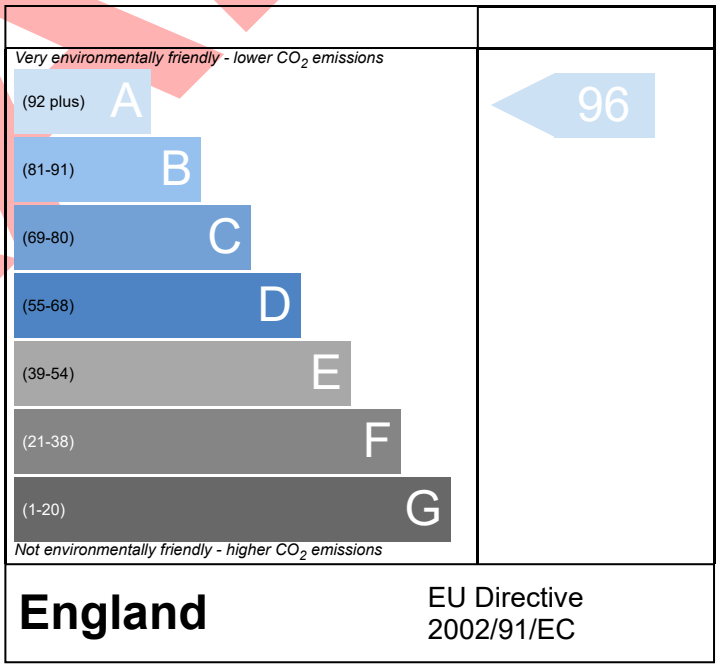
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:23

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	64 m^2
Site Reference	Unit 159 L05_Copy	Plot Reference	Unit 159 L05_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.61 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	5.6 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*62.72 kWh$_{PE}$/m^2*	
Dwelling primary energy	62.24 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*22.8 kWh/m^2*	
Dwelling fabric energy efficiency	23.4 kWh/m^2	FAIL

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	24.52	0.14 **(!)**
Party wall: Party Wall (1)	14.85	0 **(!)**
Party wall: Party Wall (2)	29.36	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	7.88	South West	0.83	1.3
NW, Opening Type 1	11.81	North West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.83 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 159 L05_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 159 L05_Copy	**Prop Type Ref**	Unit 159 L05
Property			

SAP Rating	78 C	**DER**	5.60	**TER**	11.61
Environmental	96 A	**% DER < TER**			51.77
CO_2 Emissions (t/year)	0.36	**DFEE**	23.37	**TFEE**	22.77
Compliance Check	See BREL	**% DFEE < TFEE**			-2.62
% DPER < TPER	0.76	**DPER**	62.24	**TPER**	62.72

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.3100 (1b)	x	2.4000 (2b)	=	154.3440	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.3100					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	154.3440	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.2100	19.6900	24.5200	0.1400	3.4328	14.0000	343.2800	(29a)
Total net area of external elements Aum(A, m2)			44.2100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.7645			(33)
Party Wall 1			14.8500	0.0000	0.0000	20.0000	297.0000	(32)
Wall to corridor			29.3600	0.0000	0.0000	20.0000	587.2000	(32)
Party Floor 1			64.3100			80.0000	5144.8000	(32d)
Party Ceiling 1			64.3100			80.0000	5144.8000	(32b)
Internal Wall 1			98.7600			9.0000	888.8400	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12405.9200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	192.9081 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240

E4 Jamb	23.2000	0.0500	1.1600	
E7 Party floor between dwellings (in blocks of flats)	16.3700	0.0700	1.1459	
E18 Party wall between dwellings	2.7000	0.0600	0.1620	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	14.9200	0.0000	0.0000	
E16 Corner (normal)	2.7000	0.0900	0.2430	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.1349 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 30.8994 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.4106	15.2482	15.0859	14.2741	14.1118	13.3000	13.3000	13.1377	13.6247	14.1118	14.4365	14.7612	(38)
Heat transfer coeff	46.3100	46.1477	45.9853	45.1736	45.0112	44.1995	44.1995	44.0371	44.5242	45.0112	45.3359	45.6606	(39)
Average = Sum(39)m / 12 =												45.1330	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7201	0.7176	0.7151	0.7024	0.6999	0.6873	0.6873	0.6848	0.6923	0.6999	0.7050	0.7100	(40)
HLP (average)												0.7018	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1005 (42)
Hot water usage for mixer showers

81.7276	80.4994	78.7097	75.2853	72.7583	69.9401	68.3382	70.1144	72.0615	75.0873	78.5852	81.4145	(42a)

Hot water usage for baths

25.6836	25.3022	24.7650	23.7747	23.0331	22.2107	21.7666	22.3000	22.8807	23.7606	24.7714	25.5968	(42b)

Hot water usage for other uses

36.1413	34.8271	33.5129	32.1986	30.8844	29.5702	29.5702	30.8844	32.1986	33.5129	34.8271	36.1413	(42c)

Average daily hot water use (litres/day) 132.0187 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.5526	140.6287	136.9876	131.2586	126.6757	121.7210	119.6750	123.2988	127.1408	132.3608	138.1837	143.1526	(44)
Energy conte	227.3522	200.2534	210.5448	179.6865	170.5299	149.6702	144.7365	152.6697	156.7773	179.6124	196.8681	224.1424	(45)
Energy content (annual)											Total = Sum(45)m =	2192.8435	
Distribution loss (46)m = 0.15 x (45)m	34.1028	30.0380	31.5817	26.9530	25.5795	22.4505	21.7105	22.9004	23.5166	26.9419	29.5302	33.6214	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(64)
									Total per year (kWh/year) = Sum(64)m =		2439.8755	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

92.3793	81.7446	86.7908	75.9890	73.4858	66.0085	64.9095	67.5473	68.3717	76.5058	81.7018	91.3120	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.1424	18.7785	15.2717	11.5617	8.6425	7.2964	7.8840	10.2479	13.7547	17.4647	20.3839	21.7301	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	274.1367	276.9814	269.8129	254.5520	235.2878	217.1823	205.0866	202.2419	209.4104	224.6713	243.9355	262.0411	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(70)
Losses e.g. evaporation (negative values) (Table 5)	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	(71)
Water heating gains (Table 5)	124.1657	121.6437	116.6543	105.5402	98.7713	91.6785	87.2440	90.7894	94.9607	102.8303	113.4748	122.7312	(72)
Total internal gains	511.1586	509.1174	493.4527	463.3677	434.4154	407.8709	391.9284	394.9930	409.8396	436.6802	469.5080	498.2161	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(79)
Northwest	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(81)

Solar gains	152.7958	276.2486	420.4233	592.0739	728.1137	751.4140	712.5556	606.6966	479.1778	316.7586	185.9245	128.8782	(83)
Total gains	663.9545	785.3661	913.8760	1055.4416	1162.5291	1159.2849	1104.4840	1001.6896	889.0173	753.4388	655.4324	627.0944	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	74.4135	74.6752	74.9389	76.2855	76.5607	77.9668	77.9668	78.2542	77.3982	76.5607	76.0123	75.4718	
alpha	5.9609	5.9783	5.9959	6.0857	6.1040	6.1978	6.1978	6.2169	6.1599	6.1040	6.0675	6.0315	
util living area	0.9129	0.8319	0.6961	0.5133	0.3596	0.2440	0.1761	0.2022	0.3452	0.6080	0.8411	0.9285	(86)
MIT	20.6238	20.7983	20.9311	20.9890	20.9988	20.9999	21.0000	21.0000	20.9993	20.9773	20.8219	20.5833	(87)
Th 2	20.3231	20.3253	20.3276	20.3387	20.3409	20.3521	20.3521	20.3543	20.3476	20.3409	20.3365	20.3320	(88)
util rest of house	0.8993	0.8114	0.6697	0.4863	0.3343	0.2193	0.1502	0.1738	0.3127	0.5728	0.8180	0.9169	(89)
MIT 2	19.9049	20.1099	20.2586	20.3287	20.3400	20.3520	20.3521	20.3543	20.3472	20.3210	20.1512	19.8644	(90)
Living area fraction										fLA = Living area / (4) =		0.3816	(91)
MIT	20.1792	20.3726	20.5152	20.5807	20.5914	20.5993	20.5993	20.6007	20.5960	20.5714	20.4071	20.1387	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1792	20.3726	20.5152	20.5807	20.5914	20.5993	20.5993	20.6007	20.5960	20.5714	20.4071	20.1387	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8962	0.8129	0.6772	0.4962	0.3439	0.2287	0.1600	0.1847	0.3251	0.5852	0.8206	0.9132	(94)
Useful gains	595.0388	638.4221	618.8617	523.7474	399.8206	265.1421	176.7657	184.9820	289.0372	440.9435	537.8315	572.6406	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	735.3680	714.0235	644.4936	527.6585	400.2118	265.1640	176.7674	184.9862	289.2306	448.8256	603.2915	727.7727	(97)
Space heating kWh	104.4049	50.8041	19.0701	2.8159	0.2910	0.0000	0.0000	0.0000	0.0000	5.8643	47.1312	115.4183	(98a)
Space heating requirement - total per year (kWh/year)												345.7999	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	104.4049	50.8041	19.0701	2.8159	0.2910	0.0000	0.0000	0.0000	0.0000	5.8643	47.1312	115.4183	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												345.7999	
Space heating per m2											(98c) / (4) =	5.3771	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	104.4049	50.8041	19.0701	2.8159	0.2910	0.0000	0.0000	0.0000	0.0000	5.8643	47.1312	115.4183	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	104.4049	50.8041	19.0701	2.8159	0.2910	0.0000	0.0000	0.0000	0.0000	5.8643	47.1312	115.4183	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.1948	10.1114	11.1948	10.8337	11.1948	10.8337	11.1948	11.1948	10.8337	11.1948	10.8337	11.1948	(231)
Lighting	18.5059	14.8461	13.3673	9.7934	7.5647	6.1804	6.9008	8.9699	11.6510	15.2868	17.2664	19.0202	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.4007	-24.4116	-39.4994	-49.6586	-58.3512	-56.1753	-55.2817	-49.8783	-40.7154	-29.7229	-17.7115	-12.9855	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.8931	-6.9495	-15.7665	-26.5116	-37.1419	-38.1716	-37.6311	-30.4564	-20.7964	-10.9074	-4.1606	-2.2017	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	345.7999	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2439.8755	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	131.8098	(230a)
Total electricity for the above, kWh/year	131.8098	(231)
Electricity for lighting (calculated in Appendix L)	149.3528	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-683.3800	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)

Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2383.4580	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	345.7999	16.4900	57.0224	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2439.8755	16.4900	402.3355	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	131.8098	16.4900	21.7354	(249)
Energy for lighting	149.3528	16.4900	24.6283	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-449.7921	16.4900	-74.1707	
PV Unit electricity exported	-233.5879	5.5900	-13.0576	
Total			-87.2283	(252)
Total energy cost			418.4933	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.3783	(257)
SAP value		77.6584	
SAP rating (Section 12)		78	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	345.7999	0.1597	55.2330	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2439.8755	0.1413	344.7254	(264)
Space and water heating			399.9584	(265)
Pumps, fans and electric keep-hot	131.8098	0.1387	18.2836	(267)
Energy for lighting	149.3528	0.1443	21.5562	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-449.7921	0.1323	-59.5275	
PV Unit electricity exported	-233.5879	0.1231	-28.7646	
Total			-88.2920	(269)
Total CO2, kg/year			351.5063	(272)
CO2 emissions per m2			5.4700	(273)
EI value			95.6910	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		64.3100 (1b)	x	2.4000 (2b)	=	154.3440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.3100						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		154.3440	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.2100	19.6900	24.5200	0.1400	3.4328	14.0000	343.2800	(29a)
Total net area of external elements Aum(A, m2)			44.2100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.7645			(33)
Party Wall 1			14.8500	0.0000	0.0000	20.0000	297.0000	(32)
Wall to corridor			29.3600	0.0000	0.0000	20.0000	587.2000	(32)
Party Floor 1			64.3100			80.0000	5144.8000	(32d)
Party Ceiling 1			64.3100			80.0000	5144.8000	(32b)
Internal Wall 1			98.7600			9.0000	888.8400	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12405.9200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 192.9081 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.3700	0.0700	1.1459
E18 Party wall between dwellings	2.7000	0.0600	0.1620
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	14.9200	0.0000	0.0000
E16 Corner (normal)	2.7000	0.0900	0.2430

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.1349 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 30.8994 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.5729	15.5729	15.2482	14.2741	14.1118	13.4624	13.1377	13.1377	13.7871	14.5988	14.9235	14.7612	(38)
Heat transfer coeff	46.4724	46.4724	46.1477	45.1736	45.0112	44.3618	44.0371	44.0371	44.6865	45.4983	45.8230	45.6606	(39)

Average = Sum(39)m / 12 = 45.2818

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7226	0.7226	0.7176	0.7024	0.6999	0.6898	0.6848	0.6848	0.6949	0.7075	0.7125	0.7100	(40)
HLP (average)												0.7041	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1005 (42)
Hot water usage for mixer showers

81.7276	80.4994	78.7097	75.2853	72.7583	69.9401	68.3382	70.1144	72.0615	75.0873	78.5852	81.4145	(42a)

Hot water usage for baths

25.6836	25.3022	24.7650	23.7747	23.0331	22.2107	21.7666	22.3000	22.8807	23.7606	24.7714	25.5968	(42b)

Hot water usage for other uses

36.1413	34.8271	33.5129	32.1986	30.8844	29.5702	29.5702	30.8844	32.1986	33.5129	34.8271	36.1413	(42c)

Average daily hot water use (litres/day) 132.0187 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.5526	140.6287	136.9876	131.2586	126.6757	121.7210	119.6750	123.2988	127.1408	132.3608	138.1837	143.1526	(44)
Energy conte	227.3522	200.2534	210.5448	179.6865	170.5299	149.6702	144.7365	152.6697	156.7773	179.6124	196.8681	224.1424	(45)
Energy content (annual)											Total = Sum(45)m =	2192.8435	
Distribution loss (46)m = 0.15 x (45)m	34.1028	30.0380	31.5817	26.9530	25.5795	22.4505	21.7105	22.9004	23.5166	26.9419	29.5302	33.6214	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(64)

Total per year (kWh/year) = Sum(64)m = 2439.8755 (64)
Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month

92.3793	81.7446	86.7908	75.9890	73.4858	66.0085	64.9095	67.5473	68.3717	76.5058	81.7018	91.3120	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	21.1424	18.7785	15.2717	11.5617	8.6425	7.2964	7.8840	10.2479	13.7547	17.4647	20.3839	21.7301	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	274.1367	276.9814	269.8129	254.5520	235.2878	217.1823	205.0866	202.2419	209.4104	224.6713	243.9355	262.0411	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	(71)

Water heating gains (Table 5)

	124.1657	121.6437	116.6543	105.5402	98.7713	91.6785	87.2440	90.7894	94.9607	102.8303	113.4748	122.7312	(72)

Total internal gains

	511.1586	509.1174	493.4527	463.3677	434.4154	407.8709	391.9284	394.9930	409.8396	436.6802	469.5080	498.2161	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(79)
Northwest	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(81)

Solar gains	137.9782	265.6866	421.5549	624.1600	760.9473	764.1300	733.2127	606.0620	475.9114	302.5081	172.4386	119.0880	(83)
Total gains	649.1368	774.8041	915.0076	1087.5277	1195.3628	1172.0009	1125.1411	1001.0551	885.7510	739.1883	641.9466	617.3041	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	74.1535	74.1535	74.6752	76.2855	76.5607	77.6814	78.2542	78.2542	77.1170	75.7411	75.2044	75.4718	
alpha	5.9436	5.9436	5.9783	6.0857	6.1040	6.1788	6.2169	6.2169	6.1411	6.0494	6.0136	6.0315	
util living area													
	0.9271	0.8567	0.7305	0.5380	0.3871	0.2951	0.2387	0.2727	0.4126	0.6700	0.8689	0.9400	(86)
MIT	20.5665	20.7475	20.9049	20.9848	20.9980	20.9997	20.9999	20.9999	20.9978	20.9574	20.7701	20.5273	(87)
Th 2	20.3209	20.3209	20.3253	20.3387	20.3409	20.3498	20.3543	20.3543	20.3454	20.3342	20.3298	20.3320	(88)
util rest of house													
	0.9154	0.8384	0.7058	0.5121	0.3626	0.2706	0.2135	0.2443	0.3800	0.6362	0.8486	0.9301	(89)
MIT 2	19.8337	20.0470	20.2278	20.3244	20.3393	20.3496	20.3543	20.3542	20.3438	20.2950	20.0859	19.7960	(90)
Living area fraction										fLA = Living area / (4) =		0.3816	(91)
MIT	20.1133	20.3143	20.4862	20.5764	20.5906	20.5977	20.6007	20.6006	20.5934	20.5478	20.3470	20.0750	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1133	20.3143	20.4862	20.5764	20.5906	20.5977	20.6007	20.6006	20.5934	20.5478	20.3470	20.0750	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9114	0.8382	0.7118	0.5215	0.3719	0.2799	0.2231	0.2551	0.3924	0.6472	0.8492	0.9258	(94)
Useful gains	591.6487	649.4336	651.2843	567.1101	444.5162	328.0844	251.0229	255.4024	347.5726	478.4320	545.1349	571.5150	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	753.4718	744.2246	686.9624	572.6379	445.1895	328.1751	251.0403	255.4414	348.2578	493.5547	629.9265	747.6945	(97)
Space heating kWh													
	120.3964	63.6995	26.5445	3.9801	0.5010	0.0000	0.0000	0.0000	0.0000	11.2513	61.0500	131.0776	(98a)
Space heating requirement - total per year (kWh/year)												418.5003	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	120.3964	63.6995	26.5445	3.9801	0.5010	0.0000	0.0000	0.0000	0.0000	11.2513	61.0500	131.0776	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												418.5003	
Space heating per m2											(98c) / (4) =	6.5075	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	120.3964	63.6995	26.5445	3.9801	0.5010	0.0000	0.0000	0.0000	0.0000	11.2513	61.0500	131.0776	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	120.3964	63.6995	26.5445	3.9801	0.5010	0.0000	0.0000	0.0000	0.0000	11.2513	61.0500	131.0776	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													

	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.1948	10.1114	11.1948	10.8337	11.1948	10.8337	11.1948	11.1948	10.8337	11.1948	10.8337	11.1948	(231)
Lighting	18.5059	14.8461	13.3673	9.7934	7.5647	6.1804	6.9008	8.9699	11.6510	15.2868	17.2664	19.0202	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-13.9632	-23.5442	-39.5900	-51.7924	-60.4179	-56.9935	-56.5645	-49.8935	-40.4465	-28.5276	-16.4999	-12.0106	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4329	-6.4348	-15.6570	-28.5444	-39.6226	-39.2313	-39.3039	-30.4736	-20.5513	-10.0788	-3.6407	-1.9141	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	418.5003	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2439.8755	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	131.8098	(230a)
Total electricity for the above, kWh/year	131.8098	(231)
Electricity for lighting (calculated in Appendix L)	149.3528	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-688.1289	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2451.4094	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	418.5003	25.1600	105.2947	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2439.8755	25.1600	613.8727	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	131.8098	25.1600	33.1633	(249)
Energy for lighting	149.3528	25.1600	37.5772	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-450.2436	25.1600	-113.2813	
PV Unit electricity exported	-237.8853	5.8100	-13.8211	
Total			-127.1024	(252)
Total energy cost			662.8054	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	418.5003	0.1592	66.6275	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2439.8755	0.1413	344.7254	(264)
Space and water heating			411.3529	(265)
Pumps, fans and electric keep-hot	131.8098	0.1387	18.2836	(267)
Energy for lighting	149.3528	0.1443	21.5562	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-450.2436	0.1320	-59.4512	
PV Unit electricity exported	-237.8853	0.1226	-29.1704	
Total			-88.6216	(269)
Total CO2, kg/year			362.5711	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	418.5003	1.5892	665.0908	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2439.8755	1.5225	3714.5924	(278)
Space and water heating			4379.6831	(279)
Pumps, fans and electric keep-hot	131.8098	1.5128	199.4018	(281)
Energy for lighting	149.3528	1.5338	229.0823	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-450.2436	1.4879	-669.9030	
PV Unit electricity exported	-237.8853	0.4500	-107.0542	
Total			-776.9572	(283)
Total Primary energy kWh/year			4031.2101	(286)

SAP 10 EPC IMPROVEMENTS

Unit 159 L05_Copy

Current energy efficiency rating: C 78
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Typical annual savings — Energy efficiency — Environmental impact

Recommended measures
(none)

Total Savings £0 0.00 kg/m²

Potential energy efficiency rating: C 78
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£790	£790	£0
Space heating	£138	£138	£0
Water heating	£614	£614	£0
Lighting	£38	£38	£0
Generated (PV)	-£127	-£127	£0
Total cost of fuels	£663	£663	£0
Total cost of uses	£663	£663	£0
Delivered energy	38 kWh/m²	38 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	63 kWh/m²	63 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.3100 (1b)	x	2.4000 (2b)	=	154.3440	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.3100					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	154.3440	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.2100	19.6900	24.5200	0.1400	3.4328	14.0000	343.2800	(29a)
Total net area of external elements Aum(A, m2)			44.2100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.7645			(33)
Party Wall 1			14.8500	0.0000	0.0000	20.0000	297.0000	(32)
Wall to corridor			29.3600	0.0000	0.0000	20.0000	587.2000	(32)
Party Floor 1			64.3100			80.0000	5144.8000	(32d)
Party Ceiling 1			64.3100			80.0000	5144.8000	(32b)
Internal Wall 1			98.7600			9.0000	888.8400	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12405.9200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 192.9081 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.3700	0.0700	1.1459
E18 Party wall between dwellings	2.7000	0.0600	0.1620
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	14.9200	0.0000	0.0000
E16 Corner (normal)	2.7000	0.0900	0.2430

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.1349 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 30.8994 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.4106	15.2482	15.0859	14.2741	14.1118	13.3000	13.3000	13.1377	13.6247	14.1118	14.4365	14.7612	(38)
Heat transfer coeff	46.3100	46.1477	45.9853	45.1736	45.0112	44.1995	44.1995	44.0371	44.5242	45.0112	45.3359	45.6606	(39)
Average = Sum(39)m / 12 =												45.1330	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7201	0.7176	0.7151	0.7024	0.6999	0.6873	0.6873	0.6848	0.6923	0.6999	0.7050	0.7100	(40)
HLP (average)												0.7018	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1005 (42)
Hot water usage for mixer showers

81.7276	80.4994	78.7097	75.2853	72.7583	69.9401	68.3382	70.1144	72.0615	75.0873	78.5852	81.4145	(42a)

Hot water usage for baths

25.6836	25.3022	24.7650	23.7747	23.0331	22.2107	21.7666	22.3000	22.8807	23.7606	24.7714	25.5968	(42b)

Hot water usage for other uses

36.1413	34.8271	33.5129	32.1986	30.8844	29.5702	29.5702	30.8844	32.1986	33.5129	34.8271	36.1413	(42c)

Average daily hot water use (litres/day) 132.0187 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.5526	140.6287	136.9876	131.2586	126.6757	121.7210	119.6750	123.2988	127.1408	132.3608	138.1837	143.1526	(44)
Energy conte	227.3522	200.2534	210.5448	179.6865	170.5299	149.6702	144.7365	152.6697	156.7773	179.6124	196.8681	224.1424	(45)
Energy content (annual)										Total = Sum(45)m =		2192.8435	
Distribution loss (46)m = 0.15 x (45)m	34.1028	30.0380	31.5817	26.9530	25.5795	22.4505	21.7105	22.9004	23.5166	26.9419	29.5302	33.6214	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(64)
										Total per year (kWh/year) = Sum(64)m =		2439.8755	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	92.3793	81.7446	86.7908	75.9890	73.4858	66.0085	64.9095	67.5473	68.3717	76.5058	81.7018	91.3120	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.1424	18.7785	15.2717	11.5617	8.6425	7.2964	7.8840	10.2479	13.7547	17.4647	20.3839	21.7301	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	274.1367	276.9814	269.8129	254.5520	235.2878	217.1823	205.0866	202.2419	209.4104	224.6713	243.9355	262.0411	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	(71)
Water heating gains (Table 5)	124.1657	121.6437	116.6543	105.5402	98.7713	91.6785	87.2440	90.7894	94.9607	102.8303	113.4748	122.7312	(72)
Total internal gains	511.1586	509.1174	493.4527	463.3677	434.4154	407.8709	391.9284	394.9930	409.8396	436.6802	469.5080	498.2161	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(79)
Northwest	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(81)

Solar gains	152.7958	276.2486	420.4233	592.0739	728.1137	751.4140	712.5556	606.6966	479.1778	316.7586	185.9245	128.8782	(83)
Total gains	663.9545	785.3661	913.8760	1055.4416	1162.5291	1159.2849	1104.4840	1001.6896	889.0173	753.4388	655.4324	627.0944	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	74.4135	74.6752	74.9389	76.2855	76.5607	77.9668	77.9668	78.2542	77.3982	76.5607	76.0123	75.4718	
alpha	5.9609	5.9783	5.9959	6.0857	6.1040	6.1978	6.1978	6.2169	6.1599	6.1040	6.0675	6.0315	
util living area	0.9129	0.8319	0.6961	0.5133	0.3596	0.2440	0.1761	0.2022	0.3452	0.6080	0.8411	0.9285	(86)
MIT	20.6238	20.7983	20.9311	20.9890	20.9988	20.9999	21.0000	21.0000	20.9993	20.9773	20.8219	20.5833	(87)
Th 2	20.3231	20.3253	20.3276	20.3387	20.3409	20.3521	20.3521	20.3543	20.3476	20.3409	20.3365	20.3320	(88)
util rest of house	0.8993	0.8114	0.6697	0.4863	0.3343	0.2193	0.1502	0.1738	0.3127	0.5728	0.8180	0.9169	(89)
MIT 2	19.9049	20.1099	20.2586	20.3287	20.3400	20.3520	20.3521	20.3543	20.3472	20.3210	20.1512	19.8644	(90)
Living area fraction									fLA = Living area / (4) =			0.3816	(91)
MIT	20.1792	20.3726	20.5152	20.5807	20.5914	20.5993	20.5993	20.6007	20.5960	20.5714	20.4071	20.1387	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1792	20.3726	20.5152	20.5807	20.5914	20.5993	20.5993	20.6007	20.5960	20.5714	20.4071	20.1387	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8962	0.8129	0.6772	0.4962	0.3439	0.2287	0.1600	0.1847	0.3251	0.5852	0.8206	0.9132	(94)
Useful gains	595.0388	638.4221	618.8617	523.7474	399.8206	265.1421	176.7657	184.9820	289.0372	440.9435	537.8315	572.6406	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	735.3680	714.0235	644.4936	527.6585	400.2118	265.1640	176.7674	184.9862	289.2306	448.8256	603.2915	727.7727	(97)
Space heating kWh	104.4049	50.8041	19.0701	2.8159	0.2910	0.0000	0.0000	0.0000	0.0000	5.8643	47.1312	115.4183	(98a)
Space heating requirement - total per year (kWh/year)												345.7999	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	104.4049	50.8041	19.0701	2.8159	0.2910	0.0000	0.0000	0.0000	0.0000	5.8643	47.1312	115.4183	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												345.7999	
Space heating per m2											(98c) / (4) =	5.3771	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	104.4049	50.8041	19.0701	2.8159	0.2910	0.0000	0.0000	0.0000	0.0000	5.8643	47.1312	115.4183	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	104.4049	50.8041	19.0701	2.8159	0.2910	0.0000	0.0000	0.0000	0.0000	5.8643	47.1312	115.4183	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.1948	10.1114	11.1948	10.8337	11.1948	10.8337	11.1948	11.1948	10.8337	11.1948	10.8337	11.1948	(231)
Lighting	18.5059	14.8461	13.3673	9.7934	7.5647	6.1804	6.9008	8.9699	11.6510	15.2868	17.2664	19.0202	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.4007	-24.4116	-39.4994	-49.6586	-58.3512	-56.1753	-55.2817	-49.8783	-40.7154	-29.7229	-17.7115	-12.9855	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.8931	-6.9495	-15.7665	-26.5116	-37.1419	-38.1716	-37.6311	-30.4564	-20.7964	-10.9074	-4.1606	-2.2017	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity)

(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year		
Space heating fuel - main system 1	345.7999	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2439.8755	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	131.8098	(230a)
Total electricity for the above, kWh/year	131.8098	(231)
Electricity for lighting (calculated in Appendix L)	149.3528	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-683.3800	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2383.4580	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	345.7999	16.4900	57.0224	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2439.8755	16.4900	402.3355	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	131.8098	16.4900	21.7354	(249)
Energy for lighting	149.3528	16.4900	24.6283	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-449.7921	16.4900	-74.1707	
PV Unit electricity exported	-233.5879	5.5900	-13.0576	
Total			-87.2283	(252)
Total energy cost			418.4933	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.3783	(257)
SAP value	77.6584	
SAP rating (Section 12)	78	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	345.7999	0.1597	55.2330	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2439.8755	0.1413	344.7254	(264)
Space and water heating			399.9584	(265)
Pumps, fans and electric keep-hot	131.8098	0.1387	18.2836	(267)
Energy for lighting	149.3528	0.1443	21.5562	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-449.7921	0.1323	-59.5275	
PV Unit electricity exported	-233.5879	0.1231	-28.7646	
Total			-88.2920	(269)
Total CO2, kg/year			351.5063	(272)
CO2 emissions per m2			5.4700	(273)
EI value			95.6910	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		64.3100 (1b)	x	2.4000 (2b)	=	154.3440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.3100						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		154.3440	(5)

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2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.2100	19.6900	24.5200	0.1400	3.4328	14.0000	343.2800	(29a)
Total net area of external elements Aum(A, m2)			44.2100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.7645			(33)
Party Wall 1			14.8500	0.0000	0.0000	20.0000	297.0000	(32)
Wall to corridor			29.3600	0.0000	0.0000	20.0000	587.2000	(32)
Party Floor 1			64.3100			80.0000	5144.8000	(32d)
Party Ceiling 1			64.3100			80.0000	5144.8000	(32b)
Internal Wall 1			98.7600			9.0000	888.8400	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12405.9200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		192.9081 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.3700	0.0700	1.1459
E18 Party wall between dwellings	2.7000	0.0600	0.1620
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	14.9200	0.0000	0.0000
E16 Corner (normal)	2.7000	0.0900	0.2430

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.1349 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	30.8994 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.5729	15.5729	15.2482	14.2741	14.1118	13.4624	13.1377	13.1377	13.7871	14.5988	14.9235	14.7612	(38)
Heat transfer coeff	46.4724	46.4724	46.1477	45.1736	45.0112	44.3618	44.0371	44.0371	44.6865	45.4983	45.8230	45.6606	(39)
Average = Sum(39)m / 12 =												45.2818	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7226	0.7226	0.7176	0.7024	0.6999	0.6898	0.6848	0.6848	0.6949	0.7075	0.7125	0.7100	(40)
HLP (average)												0.7041	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.1005 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
81.7276	80.4994	78.7097	75.2853	72.7583	69.9401	68.3382	70.1144	72.0615	75.0873	78.5852	81.4145	(42a)

Hot water usage for baths

25.6836	25.3022	24.7650	23.7747	23.0331	22.2107	21.7666	22.3000	22.8807	23.7606	24.7714	25.5968	(42b)

Hot water usage for other uses

36.1413	34.8271	33.5129	32.1986	30.8844	29.5702	29.5702	30.8844	32.1986	33.5129	34.8271	36.1413	(42c)

Average daily hot water use (litres/day)	132.0187 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.5526	140.6287	136.9876	131.2586	126.6757	121.7210	119.6750	123.2988	127.1408	132.3608	138.1837	143.1526	(44)
Energy conte	227.3522	200.2534	210.5448	179.6865	170.5299	149.6702	144.7365	152.6697	156.7773	179.6124	196.8681	224.1424	(45)
Energy content (annual)										Total = Sum(45)m =		2192.8435	
Distribution loss (46)m = 0.15 x (45)m	34.1028	30.0380	31.5817	26.9530	25.5795	22.4505	21.7105	22.9004	23.5166	26.9419	29.5302	33.6214	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(64)
									Total per year (kWh/year) = Sum(64)m =			2439.8755	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month													
	92.3793	81.7446	86.7908	75.9890	73.4858	66.0085	64.9095	67.5473	68.3717	76.5058	81.7018	91.3120	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.1424	18.7785	15.2717	11.5617	8.6425	7.2964	7.8840	10.2479	13.7547	17.4647	20.3839	21.7301	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	274.1367	276.9814	269.8129	254.5520	235.2878	217.1823	205.0866	202.2419	209.4104	224.6713	243.9355	262.0411	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	(71)
Water heating gains (Table 5)													
	124.1657	121.6437	116.6543	105.5402	98.7713	91.6785	87.2440	90.7894	94.9607	102.8303	113.4748	122.7312	(72)
Total internal gains													
	511.1586	509.1174	493.4527	463.3677	434.4154	407.8709	391.9284	394.9930	409.8396	436.6802	469.5080	498.2161	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(79)
Northwest	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(81)

Solar gains	137.9782	265.6866	421.5549	624.1600	760.9473	764.1300	733.2127	606.0620	475.9114	302.5081	172.4386	119.0880	(83)
Total gains	649.1368	774.8041	915.0076	1087.5277	1195.3628	1172.0009	1125.1411	1001.0551	885.7510	739.1883	641.9466	617.3041	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	74.1535	74.1535	74.6752	76.2855	76.5607	77.6814	78.2542	78.2542	77.1170	75.7411	75.2044	75.4718	
alpha	5.9436	5.9436	5.9783	6.0857	6.1040	6.1788	6.2169	6.2169	6.1411	6.0494	6.0136	6.0315	
util living area													
	0.9271	0.8567	0.7305	0.5380	0.3871	0.2951	0.2387	0.2727	0.4126	0.6700	0.8689	0.9400	(86)
MIT	20.5665	20.7475	20.9049	20.9848	20.9980	20.9997	20.9999	20.9999	20.9978	20.9574	20.7701	20.5273	(87)
Th 2	20.3209	20.3209	20.3253	20.3387	20.3409	20.3498	20.3543	20.3543	20.3454	20.3342	20.3298	20.3320	(88)
util rest of house													
	0.9154	0.8384	0.7058	0.5121	0.3626	0.2706	0.2135	0.2443	0.3800	0.6362	0.8486	0.9301	(89)
MIT 2	19.8337	20.0470	20.2278	20.3244	20.3393	20.3496	20.3543	20.3542	20.3438	20.2950	20.0859	19.7960	(90)
Living area fraction										fLA = Living area / (4) =		0.3816	(91)
MIT	20.1133	20.3143	20.4862	20.5764	20.5906	20.5977	20.6007	20.6006	20.5934	20.5478	20.3470	20.0750	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1133	20.3143	20.4862	20.5764	20.5906	20.5977	20.6007	20.6006	20.5934	20.5478	20.3470	20.0750	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9114	0.8382	0.7118	0.5215	0.3719	0.2799	0.2231	0.2551	0.3924	0.6472	0.8492	0.9258	(94)
Useful gains	591.6487	649.4336	651.2843	567.1101	444.5162	328.0844	251.0229	255.4024	347.5726	478.4320	545.1349	571.5150	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	753.4718	744.2246	686.9624	572.6379	445.1895	328.1751	251.0403	255.4414	348.2578	493.5547	629.9265	747.6945	(97)
Space heating kWh													
	120.3964	63.6995	26.5445	3.9801	0.5010	0.0000	0.0000	0.0000	0.0000	11.2513	61.0500	131.0776	(98a)
Space heating requirement - total per year (kWh/year)												418.5003	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	120.3964	63.6995	26.5445	3.9801	0.5010	0.0000	0.0000	0.0000	0.0000	11.2513	61.0500	131.0776	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												418.5003	
Space heating per m2											(98c) / (4) =	6.5075	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	120.3964	63.6995	26.5445	3.9801	0.5010	0.0000	0.0000	0.0000	0.0000	11.2513	61.0500	131.0776	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	120.3964	63.6995	26.5445	3.9801	0.5010	0.0000	0.0000	0.0000	0.0000	11.2513	61.0500	131.0776	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.1948	10.1114	11.1948	10.8337	11.1948	10.8337	11.1948	11.1948	10.8337	11.1948	10.8337	11.1948	(231)
Lighting	18.5059	14.8461	13.3673	9.7934	7.5647	6.1804	6.9008	8.9699	11.6510	15.2868	17.2664	19.0202	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-13.9632	-23.5442	-39.5900	-51.7924	-60.4179	-56.9935	-56.5645	-49.8935	-40.4465	-28.5276	-16.4999	-12.0106	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4329	-6.4348	-15.6570	-28.5444	-39.6226	-39.2313	-39.3039	-30.4736	-20.5513	-10.0788	-3.6407	-1.9141	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1	418.5003	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2439.8755	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	131.8098	(230a)
Total electricity for the above, kWh/year	131.8098	(231)
Electricity for lighting (calculated in Appendix L)	149.3528	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-688.1289	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2451.4094	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	418.5003	25.1600	105.2947	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2439.8755	25.1600	613.8727	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	131.8098	25.1600	33.1633	(249)
Energy for lighting	149.3528	25.1600	37.5772	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-450.2436	25.1600	-113.2813	
PV Unit electricity exported	-237.8853	5.8100	-13.8211	
Total			-127.1024	(252)
Total energy cost			662.8054	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	418.5003	0.1592	66.6275	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2439.8755	0.1413	344.7254	(264)
Space and water heating			411.3529	(265)
Pumps, fans and electric keep-hot	131.8098	0.1387	18.2836	(267)
Energy for lighting	149.3528	0.1443	21.5562	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-450.2436	0.1320	-59.4512	
PV Unit electricity exported	-237.8853	0.1226	-29.1704	
Total			-88.6216	(269)
Total CO2, kg/year			362.5711	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	418.5003	1.5892	665.0908	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2439.8755	1.5225	3714.5924	(278)
Space and water heating			4379.6831	(279)
Pumps, fans and electric keep-hot	131.8098	1.5128	199.4018	(281)
Energy for lighting	149.3528	1.5338	229.0823	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-450.2436	1.4879	-669.9030	
PV Unit electricity exported	-237.8853	0.4500	-107.0542	
Total			-776.9572	(283)
Total Primary energy kWh/year			4031.2101	(286)

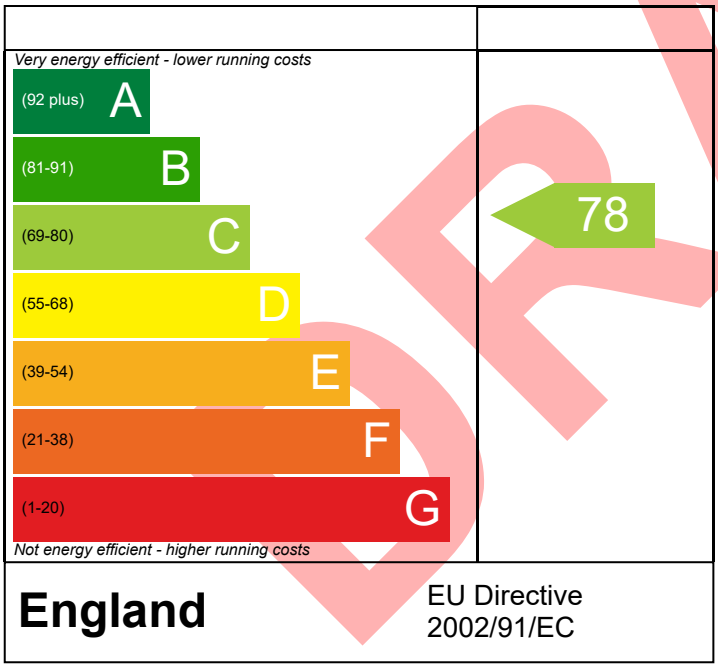
Predicted Energy Assessment

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	64.31 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

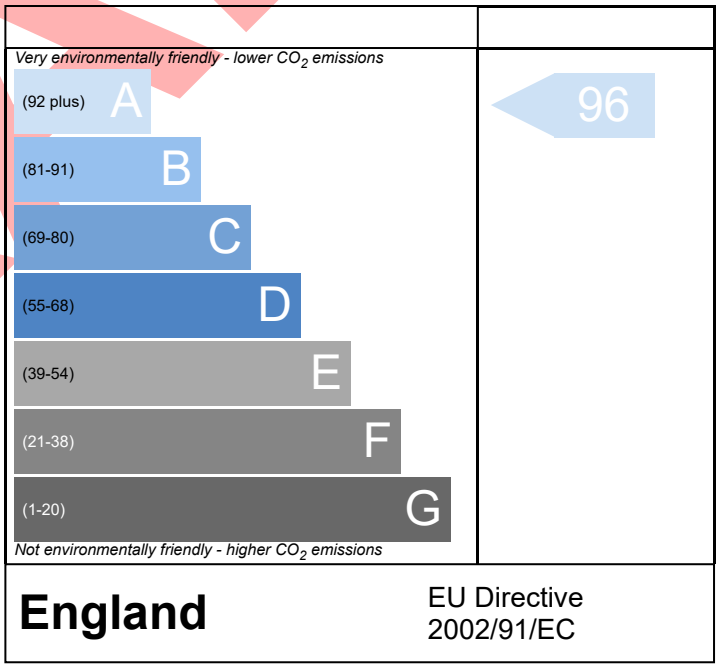
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:24

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	71 m^2
Site Reference	Unit 161 L05_Copy	Plot Reference	Unit 161 L05_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*9.51 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	4.43 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*51.39 kWh$_{PE}$/m^2*	
Dwelling primary energy	50.5 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*14.0 kWh/m^2*	
Dwelling fabric energy efficiency	12.9 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	11	0.14 **(!)**
Party wall: Party Wall (1)	52.62	0 **(!)**
Party wall: Party Wall (2)	15.55	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	11.81	South West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.92 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 161 L05_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 161 L05_Copy	**Prop Type Ref**	Unit 161 L05
Property			

SAP Rating	81 B	**DER**	4.43	**TER**	9.51
Environmental	96 A	**% DER < TER**			53.42
CO_2 Emissions (t/year)	0.31	**DFEE**	12.95	**TFEE**	14.02
Compliance Check	See BREL	**% DFEE < TFEE**			7.68
% DPER < TPER	1.73	**DPER**	50.50	**TPER**	51.39

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			136.8900			9.0000	1232.0100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 14106.2100	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.7350	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545

E4 Jamb	13.9200	0.0500	0.6960	
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.8660 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.2026	16.0392	15.8758	15.0589	14.8955	14.0786	14.0786	13.9153	14.4054	14.8955	15.2223	15.5490	(38)
Heat transfer coeff	34.2027	34.0393	33.8759	33.0590	32.8956	32.0787	32.0787	31.9154	32.4055	32.8956	33.2224	33.5491	(39)

Average = Sum(39)m / 12 = 33.0182

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4819	0.4796	0.4773	0.4658	0.4634	0.4519	0.4519	0.4496	0.4565	0.4634	0.4681	0.4727	(40)
HLP (average)												0.4652	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2697 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day) 138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)

Energy content (annual) Total = Sum(45)m = 2297.5146

Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)

Total per year (kWh/year) = Sum(64)m = 2544.5466 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	11.8100	36.7938	0.6300	0.8270	0.7700	156.8932	(79)

Solar gains	156.8932	267.2472	365.6593	453.0696	507.4757	503.8059	485.7227	445.1333	395.9317	295.3651	187.9219	134.2679	(83)
Total gains	703.2397	811.4507	893.0014	948.1177	971.2994	939.0493	903.8213	866.4472	833.2498	761.5780	689.4197	666.6128	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.5640	115.1138	115.6690	118.5272	119.1159	122.1492	122.1492	122.7745	120.9175	119.1159	117.9443	116.7956	
alpha	8.6376	8.6743	8.7113	8.9018	8.9411	9.1433	9.1433	9.1850	9.0612	8.9411	8.8630	8.7864	
util living area													
	0.7830	0.6679	0.5487	0.4218	0.3150	0.2186	0.1562	0.1694	0.2683	0.4490	0.6634	0.8084	(86)
MIT	20.9566	20.9872	20.9974	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9997	20.9906	20.9478	(87)
Th 2	20.5375	20.5396	20.5417	20.5523	20.5544	20.5651	20.5651	20.5672	20.5608	20.5544	20.5502	20.5460	(88)
util rest of house													
	0.7656	0.6501	0.5316	0.4062	0.2999	0.2038	0.1407	0.1535	0.2513	0.4298	0.6432	0.7918	(89)
MIT 2	20.4917	20.5266	20.5392	20.5521	20.5544	20.5651	20.5651	20.5672	20.5608	20.5542	20.5409	20.4903	(90)
Living area fraction										fLA = Living area / (4) =		0.4060	(91)
MIT	20.6805	20.7136	20.7253	20.7339	20.7353	20.7417	20.7417	20.7429	20.7391	20.7351	20.7235	20.6760	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6805	20.7136	20.7253	20.7339	20.7353	20.7417	20.7417	20.7429	20.7391	20.7351	20.7235	20.6760	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7711	0.6569	0.5385	0.4125	0.3060	0.2098	0.1470	0.1600	0.2582	0.4376	0.6510	0.7967	(94)
Useful gains	542.2498	533.0331	480.8626	391.1295	297.2181	197.0170	132.8596	138.6063	215.1439	333.2833	448.8144	531.0779	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	560.2549	538.2843	481.8939	391.2164	297.2233	197.0171	132.8596	138.6064	215.1447	333.3996	452.6050	552.7564	(97)
Space heating kWh													
	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(98a)
Space heating requirement - total per year (kWh/year)												36.7029	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												36.7029	
Space heating per m2											(98c) / (4) =	0.5171	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)
Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.7495	-26.5603	-43.1928	-54.4883	-64.0200	-61.6099	-60.6290	-54.7463	-44.7493	-32.6607	-19.3354	-14.1254	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.5280	-8.2015	-18.0659	-29.9413	-41.8277	-42.9674	-42.3587	-34.2994	-23.4325	-12.3753	-4.9084	-2.7087	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	36.7029	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2544.5466	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	154.2094	(230a)
Total electricity for the above, kWh/year	154.2094	(231)
Electricity for lighting (calculated in Appendix L)	163.7369	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-757.4814	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2141.7144	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	36.7029	16.4900	6.0523	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	16.4900	419.5957	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	16.4900	25.4291	(249)
Energy for lighting	163.7369	16.4900	27.0002	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-492.8668	16.4900	-81.2737	
PV Unit electricity exported	-264.6146	5.5900	-14.7920	
Total			-96.0657	(252)
Total energy cost			382.0117	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1858	(257)
SAP value		80.7789	
SAP rating (Section 12)		81	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	36.7029	0.1615	5.9279	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			365.4724	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-492.8668	0.1323	-65.2087	
PV Unit electricity exported	-264.6146	0.1235	-32.6780	
Total			-97.8867	(269)
Total CO2, kg/year			312.6088	(272)
CO2 emissions per m2			4.4000	(273)
EI value			96.3882	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			136.8900			9.0000	1232.0100	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14106.2100 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 198.7350 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.8660 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3659	16.3659	16.0392	15.0589	14.8955	14.2420	13.9153	13.9153	14.5688	15.3857	15.7124	15.5490	(38)
Heat transfer coeff	34.3660	34.3660	34.0393	33.0590	32.8956	32.2421	31.9154	31.9154	32.5689	33.3858	33.7125	33.5491	(39)

Average = Sum(39)m / 12 = 33.1679

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4842	0.4842	0.4796	0.4658	0.4634	0.4542	0.4496	0.4496	0.4588	0.4704	0.4750	0.4727	(40)
HLP (average)												0.4673	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2697 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day) 138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:

Store volume 143.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)

Temperature factor from Table 2b 0.6000 (49)

Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
										Total per year (kWh/year) = Sum(64)m =		2544.5466	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)													
	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains													
	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	11.8100	33.4622	0.6300	0.8270	0.7700	142.6869	(79)

Solar gains	142.6869	259.4069	370.9357	483.4567	536.0291	517.2027	504.8299	449.8893	398.0481	284.9819	175.6394	124.8772	(83)
Total gains	689.0334	803.6104	898.2779	978.5047	999.8527	952.4462	922.9286	871.2033	835.3662	751.1948	677.1372	657.2222	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.0193	114.0193	115.1138	118.5272	119.1159	121.5302	122.7745	122.7745	120.3109	117.3671	116.2296	116.7956	
alpha	8.6013	8.6013	8.6743	8.9018	8.9411	9.1020	9.1850	9.1850	9.0207	8.8245	8.7486	8.7864	
util living area													
	0.8121	0.7024	0.5813	0.4424	0.3389	0.2640	0.2109	0.2271	0.3197	0.5016	0.7054	0.8339	(86)
MIT	20.9408	20.9801	20.9957	20.9996	21.0000	21.0000	21.0000	21.0000	21.0000	20.9991	20.9836	20.9316	(87)
Th 2	20.5354	20.5354	20.5396	20.5523	20.5544	20.5630	20.5672	20.5672	20.5587	20.5481	20.5438	20.5460	(88)
util rest of house													
	0.7957	0.6848	0.5643	0.4273	0.3242	0.2492	0.1960	0.2113	0.3025	0.4817	0.6853	0.8185	(89)
MIT 2	20.4720	20.5147	20.5353	20.5520	20.5544	20.5630	20.5672	20.5672	20.5587	20.5473	20.5274	20.4721	(90)
Living area fraction										fLA = Living area / (4) =		0.4060	(91)
MIT	20.6623	20.7037	20.7222	20.7337	20.7353	20.7404	20.7429	20.7429	20.7379	20.7307	20.7126	20.6587	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6623	20.7037	20.7222	20.7337	20.7353	20.7404	20.7429	20.7429	20.7379	20.7307	20.7126	20.6587	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8002	0.6912	0.5711	0.4334	0.3302	0.2553	0.2021	0.2177	0.3095	0.4898	0.6928	0.8224	(94)
Useful gains	551.3951	555.4826	512.9858	424.1297	330.1075	243.1179	186.4793	189.6708	258.5229	367.9207	469.1053	540.4930	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	576.0546	563.7301	514.7494	424.2710	330.1185	243.1186	186.4794	189.6709	258.5275	368.2690	475.7715	568.9488	(97)
Space heating kWh													
	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711	(98a)
Space heating requirement - total per year (kWh/year)												51.5410	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												51.5410	
Space heating per m2											(98c) / (4) =	0.7261	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)

Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-15.1816	-25.5601	-43.1889	-56.7799	-66.2625	-62.5005	-62.0252	-54.7629	-44.4553	-31.2938	-17.9805	-13.0606 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.9923	-7.6695	-18.0487	-32.2682	-44.6258	-44.1582	-44.2385	-34.3187	-23.1566	-11.4989	-4.3440	-2.3741 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	51.5410 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2544.5466 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	154.2094 (230a)
Total electricity for the above, kWh/year	154.2094 (231)
Electricity for lighting (calculated in Appendix L)	163.7369 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-762.7453 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2151.2886 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	51.5410	25.1600	12.9677	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	25.1600	640.2079	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	25.1600	38.7991	(249)
Energy for lighting	163.7369	25.1600	41.1962	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.0518	25.1600	-124.0518	
PV Unit electricity exported	-269.6935	5.8100	-15.6692	
Total			-139.7210	(252)
Total energy cost			593.4499	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	51.5410	0.1611	8.3045	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			367.8491	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.0518	0.1320	-65.0800	
PV Unit electricity exported	-269.6935	0.1230	-33.1742	
Total			-98.2543	(269)
Total CO2, kg/year			314.6179	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	51.5410	1.5962	82.2716	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	1.5225	3874.0629	(278)
Space and water heating			3956.3345	(279)
Pumps, fans and electric keep-hot	154.2094	1.5128	233.2880	(281)
Energy for lighting	163.7369	1.5338	251.1452	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.0518	1.4877	-733.5071	
PV Unit electricity exported	-269.6935	0.4514	-121.7494	
Total			-855.2565	(283)
Total Primary energy kWh/year			3585.5112	(286)

SAP 10 EPC IMPROVEMENTS

Unit 161 L05_Copy

Current energy efficiency rating: B 81
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: B 81
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£733	£733	£0
Space heating	£52	£52	£0
Water heating	£640	£640	£0
Lighting	£41	£41	£0
Generated (PV)	-£140	-£140	£0
Total cost of fuels	£593	£593	£0
Total cost of uses	£593	£593	£0
Delivered energy	30 kWh/m²	30 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	4 kg/m²	4 kg/m²	0 kg/m²
Primary energy	51 kWh/m²	51 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			136.8900			9.0000	1232.0100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14106.2100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		198.7350 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.8660 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.2026	16.0392	15.8758	15.0589	14.8955	14.0786	14.0786	13.9153	14.4054	14.8955	15.2223	15.5490	(38)
Heat transfer coeff	34.2027	34.0393	33.8759	33.0590	32.8956	32.0787	32.0787	31.9154	32.4055	32.8956	33.2224	33.5491	(39)
Average = Sum(39)m / 12 =												33.0182	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4819	0.4796	0.4773	0.4658	0.4634	0.4519	0.4519	0.4496	0.4565	0.4634	0.4681	0.4727	(40)
HLP (average)												0.4652	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.2697 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)

Hot water usage for baths

26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)

Hot water usage for other uses

37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day)		138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
									Total per year (kWh/year) = Sum(64)m =		2544.5466	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest			11.8100	36.7938	0.6300	0.8270	0.7700	156.8932	(79)
Solar gains	156.8932	267.2472	365.6593	453.0696	507.4757	503.8059	485.7227	445.1333	395.9317	295.3651	187.9219	134.2679	(83)
Total gains	703.2397	811.4507	893.0014	948.1177	971.2994	939.0493	903.8213	866.4472	833.2498	761.5780	689.4197	666.6128	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.5640	115.1138	115.6690	118.5272	119.1159	122.1492	122.1492	122.7745	120.9175	119.1159	117.9443	116.7956	
alpha	8.6376	8.6743	8.7113	8.9018	8.9411	9.1433	9.1433	9.1850	9.0612	8.9411	8.8630	8.7864	
util living area	0.7830	0.6679	0.5487	0.4218	0.3150	0.2186	0.1562	0.1694	0.2683	0.4490	0.6634	0.8084	(86)
MIT	20.9566	20.9872	20.9974	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9997	20.9906	20.9478	(87)
Th 2	20.5375	20.5396	20.5417	20.5523	20.5544	20.5651	20.5651	20.5672	20.5608	20.5544	20.5502	20.5460	(88)
util rest of house	0.7656	0.6501	0.5316	0.4062	0.2999	0.2038	0.1407	0.1535	0.2513	0.4298	0.6432	0.7918	(89)
MIT 2	20.4917	20.5266	20.5392	20.5521	20.5544	20.5651	20.5651	20.5672	20.5608	20.5542	20.5409	20.4903	(90)
Living area fraction									fLA = Living area / (4) =			0.4060	(91)
MIT	20.6805	20.7136	20.7253	20.7339	20.7353	20.7417	20.7417	20.7429	20.7391	20.7351	20.7235	20.6760	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6805	20.7136	20.7253	20.7339	20.7353	20.7417	20.7417	20.7429	20.7391	20.7351	20.7235	20.6760	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7711	0.6569	0.5385	0.4125	0.3060	0.2098	0.1470	0.1600	0.2582	0.4376	0.6510	0.7967	(94)
Useful gains	542.2498	533.0331	480.8626	391.1295	297.2181	197.0170	132.8596	138.6063	215.1439	333.2833	448.8144	531.0779	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	560.2549	538.2843	481.8939	391.2164	297.2233	197.0171	132.8596	138.6064	215.1447	333.3996	452.6050	552.7564	(97)
Space heating kWh	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(98a)
Space heating requirement - total per year (kWh/year)												36.7029	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												36.7029	
Space heating per m2										(98c) / (4) =		0.5171	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)
Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.7495	-26.5603	-43.1928	-54.4883	-64.0200	-61.6099	-60.6290	-54.7463	-44.7493	-32.6607	-19.3354	-14.1254	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.5280	-8.2015	-18.0659	-29.9413	-41.8277	-42.9674	-42.3587	-34.2994	-23.4325	-12.3753	-4.9084	-2.7087	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												36.7029	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2544.5466	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	154.2094	(230a)
Total electricity for the above, kWh/year	154.2094	(231)
Electricity for lighting (calculated in Appendix L)	163.7369	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-757.4814	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2141.7144	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	36.7029	16.4900	6.0523	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	16.4900	419.5957	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	16.4900	25.4291	(249)
Energy for lighting	163.7369	16.4900	27.0002	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-492.8668	16.4900	-81.2737	
PV Unit electricity exported	-264.6146	5.5900	-14.7920	
Total			-96.0657	(252)
Total energy cost			382.0117	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.1858	(257)
SAP value	80.7789	
SAP rating (Section 12)	81	(258)
SAP band	B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	36.7029	0.1615	5.9279	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			365.4724	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-492.8668	0.1323	-65.2087	
PV Unit electricity exported	-264.6146	0.1235	-32.6780	
Total			-97.8867	(269)
Total CO2, kg/year			312.6088	(272)
CO2 emissions per m2			4.4000	(273)
EI value			96.3882	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 = 0.0000	(6a)
Number of open flues	0 * 20 = 0.0000	(6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			136.8900			9.0000	1232.0100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 14106.2100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.7350 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	1.8660 (36)
Point Thermal bridges (36a) =	0.0000
Total fabric heat loss (33) + (36) + (36a) =	18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3659	16.3659	16.0392	15.0589	14.8955	14.2420	13.9153	13.9153	14.5688	15.3857	15.7124	15.5490	(38)
Heat transfer coeff	34.3660	34.3660	34.0393	33.0590	32.8956	32.2421	31.9154	31.9154	32.5689	33.3858	33.7125	33.5491	(39)
Average = Sum(39)m / 12 =												33.1679	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4842	0.4842	0.4796	0.4658	0.4634	0.4542	0.4496	0.4496	0.4588	0.4704	0.4750	0.4727	(40)
HLP (average)												0.4673	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2697 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)
Average daily hot water use (litres/day)												138.3203	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
									Total per year (kWh/year) = Sum(64)m =			2544.5466	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	11.8100	33.4622	0.6300	0.8270	0.7700	142.6869	(79)

Solar gains	142.6869	259.4069	370.9357	483.4567	536.0291	517.2027	504.8299	449.8893	398.0481	284.9819	175.6394	124.8772	(83)
Total gains	689.0334	803.6104	898.2779	978.5047	999.8527	952.4462	922.9286	871.2033	835.3662	751.1948	677.1372	657.2222	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.0193	114.0193	115.1138	118.5272	119.1159	121.5302	122.7745	122.7745	120.3109	117.3671	116.2296	116.7956	
alpha	8.6013	8.6013	8.6743	8.9018	8.9411	9.1020	9.1850	9.1850	9.0207	8.8245	8.7486	8.7864	
util living area	0.8121	0.7024	0.5813	0.4424	0.3389	0.2640	0.2109	0.2271	0.3197	0.5016	0.7054	0.8339	(86)
MIT	20.9408	20.9801	20.9957	20.9996	21.0000	21.0000	21.0000	21.0000	21.0000	20.9991	20.9836	20.9316	(87)
Th 2	20.5354	20.5354	20.5396	20.5523	20.5544	20.5630	20.5672	20.5672	20.5587	20.5481	20.5438	20.5460	(88)
util rest of house	0.7957	0.6848	0.5643	0.4273	0.3242	0.2492	0.1960	0.2113	0.3025	0.4817	0.6853	0.8185	(89)
MIT 2	20.4720	20.5147	20.5353	20.5520	20.5544	20.5630	20.5672	20.5672	20.5587	20.5473	20.5274	20.4721	(90)
Living area fraction									fLA = Living area / (4) =			0.4060	(91)
MIT	20.6623	20.7037	20.7222	20.7337	20.7353	20.7404	20.7429	20.7429	20.7379	20.7307	20.7126	20.6587	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6623	20.7037	20.7222	20.7337	20.7353	20.7404	20.7429	20.7429	20.7379	20.7307	20.7126	20.6587	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8002	0.6912	0.5711	0.4334	0.3302	0.2553	0.2021	0.2177	0.3095	0.4898	0.6928	0.8224	(94)
Useful gains	551.3951	555.4826	512.9858	424.1297	330.1075	243.1179	186.4793	189.6708	258.5229	367.9207	469.1053	540.4930	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	576.0546	563.7301	514.7494	424.2710	330.1185	243.1186	186.4794	189.6709	258.5275	368.2690	475.7715	568.9488	(97)
Space heating kWh	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711	(98a)
Space heating requirement - total per year (kWh/year)												51.5410	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												51.5410	
Space heating per m2											(98c) / (4) =	0.7261	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													

	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972 (231)
Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-15.1816	-25.5601	-43.1889	-56.7799	-66.2625	-62.5005	-62.0252	-54.7629	-44.4553	-31.2938	-17.9805	-13.0606 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.9923	-7.6695	-18.0487	-32.2682	-44.6258	-44.1582	-44.2385	-34.3187	-23.1566	-11.4989	-4.3440	-2.3741 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	51.5410 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2544.5466 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	154.2094 (230a)
Total electricity for the above, kWh/year	154.2094 (231)
Electricity for lighting (calculated in Appendix L)	163.7369 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-762.7453 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2151.2886 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	51.5410	25.1600	12.9677	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	25.1600	640.2079	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	25.1600	38.7991	(249)
Energy for lighting	163.7369	25.1600	41.1962	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.0518	25.1600	-124.0518	
PV Unit electricity exported	-269.6935	5.8100	-15.6692	
Total			-139.7210	(252)
Total energy cost			593.4499	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	51.5410	0.1611	8.3045	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			367.8491	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.0518	0.1320	-65.0800	
PV Unit electricity exported	-269.6935	0.1230	-33.1742	
Total			-98.2543	(269)
Total CO2, kg/year			314.6179	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	51.5410	1.5962	82.2716	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	1.5225	3874.0629	(278)
Space and water heating			3956.3345	(279)

Pumps, fans and electric keep-hot	154.2094	1.5128	233.2880	(281)
Energy for lighting	163.7369	1.5338	251.1452	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.0518	1.4877	-733.5071	
PV Unit electricity exported	-269.6935	0.4514	-121.7494	
Total			-855.2565	(283)
Total Primary energy kWh/year			3585.5112	(286)

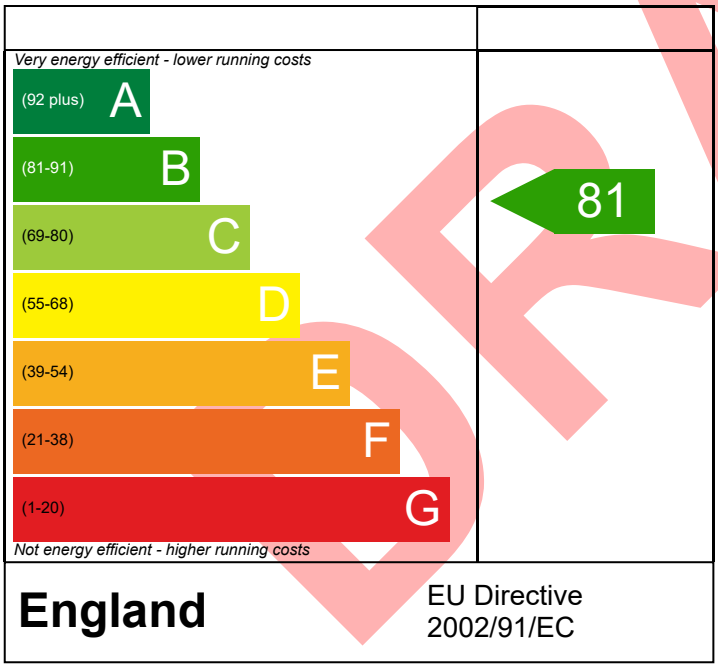
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	70.98 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

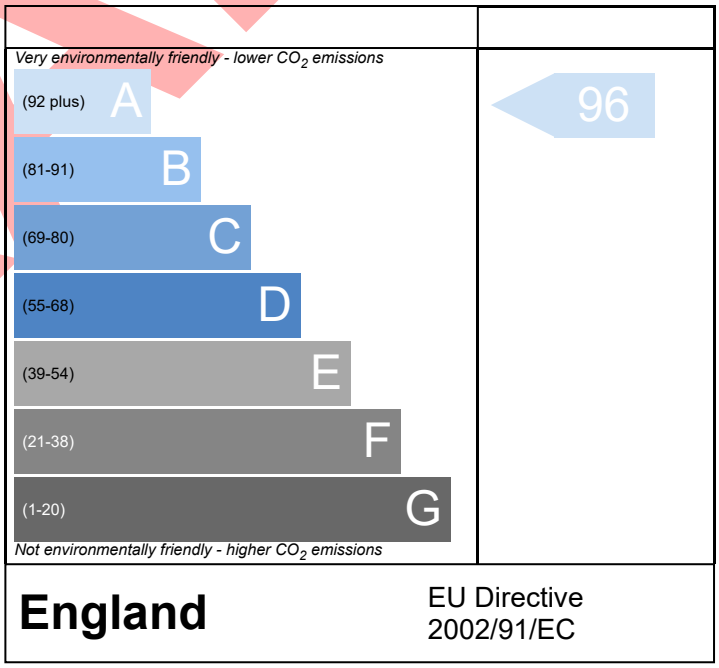
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:24

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	66 m^2
Site Reference	Unit 162 L05_Copy	Plot Reference	Unit 162 L05_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*10.63 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	5.05 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*57.39 kWh$_{PE}$/m^2*	
Dwelling primary energy	56.68 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*19.0 kWh/m^2*	
Dwelling fabric energy efficiency	18.9 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	24.21	0.14 **(!)**
Party wall: Party Wall (1)	55.93	0 **(!)**
Party wall: Party Wall (2)	3.85	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	7.88	South West	0.83	1.3
SE, Opening Type 1	11.81	South East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.86 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 162 L05_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 162 L05_Copy	**Prop Type Ref**	Unit 162 L05
Property			

SAP Rating	79 C	**DER**	5.05	**TER**	10.63
Environmental	96 A	**% DER < TER**			52.49
CO_2 Emissions (t/year)	0.34	**DFEE**	18.93	**TFEE**	19.00
Compliance Check	See BREL	**% DFEE < TFEE**			0.33
% DPER < TPER	1.24	**DPER**	56.68	**TPER**	57.39

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.5000 (1b)	x	2.4000 (2b)	=	159.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.6000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	43.9000	19.6900	24.2100	0.1400	3.3894	14.0000	338.9400	(29a)
Total net area of external elements Aum(A, m2)			43.9000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.7211			(33)
Party Wall 1			55.9300	0.0000	0.0000	20.0000	1118.6000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.5000			80.0000	5320.0000	(32d)
Party Ceiling 1			66.5000			80.0000	5320.0000	(32b)
Internal Wall 1			140.2900			9.0000	1262.6100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13437.1500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.0624 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240

E4 Jamb	23.2000	0.0500	1.1600	
E7 Party floor between dwellings (in blocks of flats)	16.1600	0.0700	1.1312	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	22.1400	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.0392 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 30.7603 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.9354	15.7675	15.5996	14.7602	14.5923	13.7529	13.7529	13.5851	14.0887	14.5923	14.9281	15.2638	(38)
Heat transfer coeff	46.6957	46.5278	46.3600	45.5206	45.3527	44.5133	44.5133	44.3454	44.8490	45.3527	45.6884	46.0242	(39)

Average = Sum(39)m / 12 = 45.4786

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7022	0.6997	0.6971	0.6845	0.6820	0.6694	0.6694	0.6668	0.6744	0.6820	0.6870	0.6921	(40)
HLP (average)												0.6839	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1583 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	83.0588	81.8106	79.9917	76.5116	73.9433	71.0793	69.4513	71.2564	73.2352	76.3103	79.8652	82.7406	(42a)
Hot water usage for baths	26.1000	25.7123	25.1665	24.1600	23.4064	22.5708	22.1194	22.6614	23.2516	24.1458	25.1729	26.0117	(42b)
Hot water usage for other uses	36.7327	35.3969	34.0612	32.7255	31.3897	30.0540	30.0540	31.3897	32.7255	34.0612	35.3969	36.7327	(42c)

Average daily hot water use (litres/day) 134.1695 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.8914	142.9198	139.2194	133.3971	128.7395	123.7040	121.6247	125.3076	129.2122	134.5173	140.4351	145.4849	(44)
Energy conte	231.0563	203.5159	213.9750	182.6139	173.3081	152.1085	147.0945	155.1570	159.3316	182.5387	200.0755	227.7943	(45)

Energy content (annual) Total = Sum(45)m = 2228.5693

Distribution loss (46)m = 0.15 x (45)m	34.6584	30.5274	32.0962	27.3921	25.9962	22.8163	22.0642	23.2735	23.8997	27.3808	30.0113	34.1691	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)

Total per year (kWh/year) = Sum(64)m = 2475.6013 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	93.6109	82.8294	87.9313	76.9623	74.4096	66.8193	65.6936	68.3743	69.2210	77.4788	82.7683	92.5262	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7552	19.3227	15.7143	11.8967	8.8930	7.5078	8.1125	10.5449	14.1533	17.9709	20.9747	22.3598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	282.0814	285.0085	277.6323	261.9291	242.1067	223.4764	211.0302	208.1031	215.4793	231.1825	251.0049	269.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	(71)
Water heating gains (Table 5)	125.8211	123.2580	118.1873	106.8921	100.0129	92.8046	88.2978	91.9010	96.1402	104.1381	114.9560	124.3632	(72)
Total internal gains	522.9304	520.8621	504.8066	473.9908	444.2853	417.0615	400.7133	403.8217	419.0457	446.5643	480.2084	509.6310	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	11.8100	36.7938	0.6300	0.8270	0.7700	156.8932	(77)
Southwest	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(79)

Solar gains	261.5773	445.5629	609.6386	755.3718	846.0793	839.9609	809.8120	742.1401	660.1097	492.4419	313.3093	223.8557	(83)
Total gains	784.5077	966.4250	1114.4452	1229.3625	1290.3646	1257.0225	1210.5252	1145.9618	1079.1553	939.0062	793.5177	733.4867	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	79.9333	80.2217	80.5122	81.9968	82.3004	83.8523	83.8523	84.1698	83.2246	82.3004	81.6955	81.0996	
alpha	6.3289	6.3481	6.3675	6.4665	6.4867	6.5902	6.5902	6.6113	6.5483	6.4867	6.4464	6.4066	
util living area	0.8610	0.7342	0.5934	0.4467	0.3267	0.2266	0.1618	0.1780	0.2867	0.4994	0.7534	0.8867	(86)
MIT	20.7806	20.9169	20.9770	20.9964	20.9996	21.0000	21.0000	21.0000	20.9999	20.9943	20.9214	20.7412	(87)
Th 2	20.3389	20.3411	20.3434	20.3545	20.3568	20.3680	20.3680	20.3702	20.3635	20.3568	20.3523	20.3478	(88)
util rest of house	0.8427	0.7107	0.5685	0.4232	0.3042	0.2042	0.1386	0.1536	0.2603	0.4693	0.7265	0.8706	(89)
MIT 2	20.1020	20.2557	20.3211	20.3513	20.3564	20.3679	20.3680	20.3702	20.3634	20.3519	20.2739	20.0650	(90)
Living area fraction									fLA = Living area / (4) =			0.3370	(91)
MIT	20.3307	20.4785	20.5421	20.5687	20.5732	20.5809	20.5810	20.5824	20.5779	20.5684	20.4921	20.2928	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3307	20.4785	20.5421	20.5687	20.5732	20.5809	20.5810	20.5824	20.5779	20.5684	20.4921	20.2928	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8425	0.7157	0.5761	0.4310	0.3118	0.2118	0.1464	0.1618	0.2692	0.4793	0.7325	0.8692	(94)
Useful gains	660.9362	691.6463	641.9935	529.8378	402.2774	266.2236	177.2049	185.4711	290.4875	450.0389	581.2287	637.5157	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	748.5635	724.8350	650.9921	531.1672	402.4220	266.2311	177.2054	185.4720	290.5269	452.0934	611.8637	740.6597	(97)
Space heating kWh	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(98a)
Space heating requirement - total per year (kWh/year)												195.5822	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												195.5822	
Space heating per m2											(98c) / (4) =	2.9411	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 100.0000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5760	10.4558	11.5760	11.2026	11.5760	11.2026	11.5760	11.5760	11.2026	11.5760	11.2026	11.5760	(231)
Lighting	19.0422	15.2763	13.7546	10.0772	7.7840	6.3596	7.1008	9.2299	11.9887	15.7298	17.7668	19.5714	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.8374	-25.0495	-40.6440	-51.2425	-60.2341	-57.9825	-57.0592	-51.4970	-42.0573	-30.6737	-18.2140	-13.3632	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.1177	-7.4452	-16.6195	-27.6808	-38.7105	-39.7745	-39.2119	-31.7414	-21.6778	-11.4252	-4.4487	-2.3730	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year
Space heating fuel - main system 1 195.5822 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 100.0000
Water heating fuel used 2475.6013 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)
mechanical ventilation fans (SFP = 0.7000) 136.2984 (230a)
Total electricity for the above, kWh/year 136.2984 (231)
Electricity for lighting (calculated in Appendix L) 153.6812 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation -708.0805 (233)
Wind generation 0.0000 (234)
Hydro-electric generation (Appendix N) 0.0000 (235a)
Electricity generated - Micro CHP (Appendix N) 0.0000 (235)

Appendix Q - special features

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2253.0826	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	195.5822	16.4900	32.2515	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	16.4900	408.2267	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	136.2984	16.4900	22.4756	(249)
Energy for lighting	153.6812	16.4900	25.3420	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-463.8543	16.4900	-76.4896	
PV Unit electricity exported	-244.2261	5.5900	-13.6522	
Total			-90.1418	(252)
Total energy cost			398.1540	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2855	(257)
SAP value	79.1617	
SAP rating (Section 12)	79	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	195.5822	0.1606	31.4176	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2475.6013	0.1413	349.7834	(264)
Space and water heating			381.2010	(265)
Pumps, fans and electric keep-hot	136.2984	0.1387	18.9063	(267)
Energy for lighting	153.6812	0.1443	22.1809	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-463.8543	0.1323	-61.3768	
PV Unit electricity exported	-244.2261	0.1233	-30.1190	
Total			-91.4957	(269)
Total CO2, kg/year			330.7925	(272)
CO2 emissions per m2			4.9700	(273)
EI value			96.0246	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		66.5000 (1b)	x	2.4000 (2b)	=	159.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.5000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.6000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	43.9000	19.6900	24.2100	0.1400	3.3894	14.0000	338.9400	(29a)
Total net area of external elements Aum(A, m2)			43.9000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.7211			(33)
Party Wall 1			55.9300	0.0000	0.0000	20.0000	1118.6000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.5000			80.0000	5320.0000	(32d)
Party Ceiling 1			66.5000			80.0000	5320.0000	(32b)
Internal Wall 1			140.2900			9.0000	1262.6100	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13437.1500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 202.0624 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.1600	0.0700	1.1312
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	22.1400	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.0392 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 30.7603 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.1032	16.1032	15.7675	14.7602	14.5923	13.9208	13.5851	13.5851	14.2566	15.0960	15.4317	15.2638	(38)
Heat transfer coeff	46.8636	46.8636	46.5278	45.5206	45.3527	44.6812	44.3454	44.3454	45.0169	45.8563	46.1921	46.0242	(39)
Average = Sum(39)m / 12 =												45.6325	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7047	0.7047	0.6997	0.6845	0.6820	0.6719	0.6668	0.6668	0.6769	0.6896	0.6946	0.6921	(40)
HLP (average)												0.6862	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1583 (42)
Hot water usage for mixer showers

83.0588	81.8106	79.9917	76.5116	73.9433	71.0793	69.4513	71.2564	73.2352	76.3103	79.8652	82.7406	(42a)

Hot water usage for baths

26.1000	25.7123	25.1665	24.1600	23.4064	22.5708	22.1194	22.6614	23.2516	24.1458	25.1729	26.0117	(42b)

Hot water usage for other uses

36.7327	35.3969	34.0612	32.7255	31.3897	30.0540	30.0540	31.3897	32.7255	34.0612	35.3969	36.7327	(42c)

Average daily hot water use (litres/day) 134.1695 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.8914	142.9198	139.2194	133.3971	128.7395	123.7040	121.6247	125.3076	129.2122	134.5173	140.4351	145.4849	(44)
Energy conte	231.0563	203.5159	213.9750	182.6139	173.3081	152.1085	147.0945	155.1570	159.3316	182.5387	200.0755	227.7943	(45)
Energy content (annual)										Total = Sum(45)m =		2228.5693	
Distribution loss (46)m = 0.15 x (45)m	34.6584	30.5274	32.0962	27.3921	25.9962	22.8163	22.0642	23.2735	23.8997	27.3808	30.0113	34.1691	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)

Total per year (kWh/year) = Sum(64)m = 2475.6013 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

93.6109	82.8294	87.9313	76.9623	74.4096	66.8193	65.6936	68.3743	69.2210	77.4788	82.7683	92.5262	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.7552	19.3227	15.7143	11.8967	8.8930	7.5078	8.1125	10.5449	14.1533	17.9709	20.9747	22.3598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	282.0814	285.0085	277.6323	261.9291	242.1067	223.4764	211.0302	208.1031	215.4793	231.1825	251.0049	269.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	(71)
Water heating gains (Table 5)													
	125.8211	123.2580	118.1873	106.8921	100.0129	92.8046	88.2978	91.9010	96.1402	104.1381	114.9560	124.3632	(72)
Total internal gains													
	522.9304	520.8621	504.8066	473.9908	444.2853	417.0615	400.7133	403.8217	419.0457	446.5643	480.2084	509.6310	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	11.8100	33.4622	0.6300	0.8270	0.7700	142.6869	(77)
Southwest	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(79)

Solar gains	237.8920	432.4913	618.4356	806.0340	893.6844	862.2965	841.6682	750.0695	663.6383	475.1307	292.8315	208.1992	(83)
Total gains	760.8224	953.3534	1123.2423	1280.0248	1337.9696	1279.3581	1242.3814	1153.8912	1082.6839	921.6950	773.0399	717.8302	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000	(85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	79.6469	79.6469	80.2217	81.9968	82.3004	83.5373	84.1698	84.1698	82.9142	81.3965	80.8048	81.0996	
alpha	6.3098	6.3098	6.3481	6.4665	6.4867	6.5692	6.6113	6.6113	6.5276	6.4264	6.3870	6.4066	
util living area													
	0.8845	0.7655	0.6241	0.4641	0.3489	0.2724	0.2177	0.2383	0.3407	0.5560	0.7919	0.9054	(86)
MIT	20.7303	20.8890	20.9674	20.9952	20.9993	20.9999	21.0000	21.0000	20.9995	20.9880	20.8884	20.6918	(87)
Th 2	20.3367	20.3367	20.3411	20.3545	20.3568	20.3657	20.3702	20.3702	20.3612	20.3501	20.3456	20.3478	(88)
util rest of house													
	0.8685	0.7432	0.6000	0.4416	0.3272	0.2502	0.1952	0.2141	0.3143	0.5256	0.7669	0.8915	(89)
MIT 2	20.0414	20.2207	20.3088	20.3501	20.3562	20.3657	20.3702	20.3702	20.3609	20.3395	20.2318	20.0064	(90)
Living area fraction									fLA = Living area / (4) =			0.3370	(91)
MIT	20.2736	20.4459	20.5307	20.5675	20.5729	20.5794	20.5824	20.5824	20.5761	20.5580	20.4531	20.2374	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2736	20.4459	20.5307	20.5675	20.5729	20.5794	20.5824	20.5824	20.5761	20.5580	20.4531	20.2374	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8668	0.7469	0.6070	0.4491	0.3345	0.2577	0.2028	0.2222	0.3232	0.5354	0.7711	0.8889	(94)
Useful gains	659.5127	712.1003	681.7671	574.8005	447.5175	329.6864	251.9844	256.4141	349.9080	493.4880	596.1068	638.1040	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	767.3236	756.6545	694.6943	576.6309	447.7632	329.7195	251.9897	256.4237	350.0571	497.9093	639.9012	761.1189	(97)
Space heating kWh													
	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(98a)
Space heating requirement - total per year (kWh/year)												247.6148	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												247.6148	
Space heating per m2										(98c) / (4) =		3.7235	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(219)
Space cooling fuel requirement													

(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5760	10.4558	11.5760	11.2026	11.5760	11.2026	11.5760	11.5760	11.2026	11.5760	11.2026	11.5760	(231)
Lighting	19.0422	15.2763	13.7546	10.0772	7.7840	6.3596	7.1008	9.2299	11.9887	15.7298	17.7668	19.5714	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.3659	-24.1373	-40.6748	-53.4156	-62.3565	-58.8247	-58.3796	-51.5126	-41.7801	-29.4038	-16.9601	-12.3644	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.6228	-6.9252	-16.5691	-29.8250	-41.2999	-40.8780	-40.9539	-31.7592	-21.4223	-10.5980	-3.9084	-2.0636	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	247.6148	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2475.6013	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.2984	(230a)
Total electricity for the above, kWh/year	136.2984	(231)
Electricity for lighting (calculated in Appendix L)	153.6812	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-713.0011	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2300.1947	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	247.6148	25.1600	62.2999	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	25.1600	622.8613	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	136.2984	25.1600	34.2927	(249)
Energy for lighting	153.6812	25.1600	38.6662	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.1755	25.1600	-116.7865	
PV Unit electricity exported	-248.8256	5.8100	-14.4568	
Total			-131.2433	(252)
Total energy cost			626.8767	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	247.6148	0.1602	39.6760	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2475.6013	0.1413	349.7834	(264)
Space and water heating			389.4594	(265)
Pumps, fans and electric keep-hot	136.2984	0.1387	18.9063	(267)
Energy for lighting	153.6812	0.1443	22.1809	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.1755	0.1320	-61.2773	
PV Unit electricity exported	-248.8256	0.1228	-30.5608	
Total			-91.8382	(269)
Total CO2, kg/year			338.7085	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	247.6148	1.5930	394.4398	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	1.5225	3769.0221	(278)
Space and water heating			4163.4620	(279)
Pumps, fans and electric keep-hot	136.2984	1.5128	206.1922	(281)
Energy for lighting	153.6812	1.5338	235.7213	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.1755	1.4878	-690.5810	
PV Unit electricity exported	-248.8256	0.4508	-112.1583	
Total			-802.7393	(283)
Total Primary energy kWh/year			3802.6362	(286)

SAP 10 EPC IMPROVEMENTS

Unit 162 L05_Copy

Current energy efficiency rating: C 79
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 79
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£758	£758	£0
Space heating	£97	£97	£0
Water heating	£623	£623	£0
Lighting	£39	£39	£0
Generated (PV)	-£131	-£131	£0
Total cost of fuels	£627	£627	£0
Total cost of uses	£628	£628	£0
Delivered energy	35 kWh/m²	35 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	57 kWh/m²	57 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.5000 (1b)	x	2.4000 (2b)	=	159.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.6000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	43.9000	19.6900	24.2100	0.1400	3.3894	14.0000	338.9400	(29a)
Total net area of external elements Aum(A, m2)			43.9000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.7211			(33)
Party Wall 1			55.9300	0.0000	0.0000	20.0000	1118.6000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.5000			80.0000	5320.0000	(32d)
Party Ceiling 1			66.5000			80.0000	5320.0000	(32b)
Internal Wall 1			140.2900			9.0000	1262.6100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13437.1500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.0624 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.1600	0.0700	1.1312
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	22.1400	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.0392 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	30.7603 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.9354	15.7675	15.5996	14.7602	14.5923	13.7529	13.7529	13.5851	14.0887	14.5923	14.9281	15.2638	(38)
Heat transfer coeff	46.6957	46.5278	46.3600	45.5206	45.3527	44.5133	44.5133	44.3454	44.8490	45.3527	45.6884	46.0242	(39)
Average = Sum(39)m / 12 =												45.4786	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7022	0.6997	0.6971	0.6845	0.6820	0.6694	0.6694	0.6668	0.6744	0.6820	0.6870	0.6921	(40)
HLP (average)												0.6839	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.1583 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
83.0588	81.8106	79.9917	76.5116	73.9433	71.0793	69.4513	71.2564	73.2352	76.3103	79.8652	82.7406	(42a)

Hot water usage for baths

26.1000	25.7123	25.1665	24.1600	23.4064	22.5708	22.1194	22.6614	23.2516	24.1458	25.1729	26.0117	(42b)

Hot water usage for other uses

36.7327	35.3969	34.0612	32.7255	31.3897	30.0540	30.0540	31.3897	32.7255	34.0612	35.3969	36.7327	(42c)

Average daily hot water use (litres/day)		134.1695 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.8914	142.9198	139.2194	133.3971	128.7395	123.7040	121.6247	125.3076	129.2122	134.5173	140.4351	145.4849	(44)
Energy conte	231.0563	203.5159	213.9750	182.6139	173.3081	152.1085	147.0945	155.1570	159.3316	182.5387	200.0755	227.7943	(45)
Energy content (annual)										Total = Sum(45)m =		2228.5693	

Distribution loss (46)m = 0.15 x (45)m

34.6584	30.5274	32.0962	27.3921	25.9962	22.8163	22.0642	23.2735	23.8997	27.3808	30.0113	34.1691	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
									Total per year (kWh/year) = Sum(64)m =		2475.6013	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

93.6109	82.8294	87.9313	76.9623	74.4096	66.8193	65.6936	68.3743	69.2210	77.4788	82.7683	92.5262	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7552	19.3227	15.7143	11.8967	8.8930	7.5078	8.1125	10.5449	14.1533	17.9709	20.9747	22.3598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	282.0814	285.0085	277.6323	261.9291	242.1067	223.4764	211.0302	208.1031	215.4793	231.1825	251.0049	269.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	(71)
Water heating gains (Table 5)	125.8211	123.2580	118.1873	106.8921	100.0129	92.8046	88.2978	91.9010	96.1402	104.1381	114.9560	124.3632	(72)
Total internal gains	522.9304	520.8621	504.8066	473.9908	444.2853	417.0615	400.7133	403.8217	419.0457	446.5643	480.2084	509.6310	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	11.8100	36.7938	0.6300	0.8270	0.7700	156.8932	(77)
Southwest	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	261.5773	445.5629	609.6386	755.3718	846.0793	839.9609	809.8120	742.1401	660.1097	492.4419	313.3093	223.8557	(83)
Total gains	784.5077	966.4250	1114.4452	1229.3625	1290.3646	1257.0225	1210.5252	1145.9618	1079.1553	939.0062	793.5177	733.4867	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	79.9333	80.2217	80.5122	81.9968	82.3004	83.8523	83.8523	84.1698	83.2246	82.3004	81.6955	81.0996	
alpha	6.3289	6.3481	6.3675	6.4665	6.4867	6.5902	6.5902	6.6113	6.5483	6.4867	6.4464	6.4066	
util living area	0.8610	0.7342	0.5934	0.4467	0.3267	0.2266	0.1618	0.1780	0.2867	0.4994	0.7534	0.8867	(86)
MIT	20.7806	20.9169	20.9770	20.9964	20.9996	21.0000	21.0000	21.0000	20.9999	20.9943	20.9214	20.7412	(87)
Th 2	20.3389	20.3411	20.3434	20.3545	20.3568	20.3680	20.3680	20.3702	20.3635	20.3568	20.3523	20.3478	(88)
util rest of house	0.8427	0.7107	0.5685	0.4232	0.3042	0.2042	0.1386	0.1536	0.2603	0.4693	0.7265	0.8706	(89)
MIT 2	20.1020	20.2557	20.3211	20.3513	20.3564	20.3679	20.3680	20.3702	20.3634	20.3519	20.2739	20.0650	(90)
Living area fraction										fLA = Living area / (4) =		0.3370	(91)
MIT	20.3307	20.4785	20.5421	20.5687	20.5732	20.5809	20.5810	20.5824	20.5779	20.5684	20.4921	20.2928	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3307	20.4785	20.5421	20.5687	20.5732	20.5809	20.5810	20.5824	20.5779	20.5684	20.4921	20.2928	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8425	0.7157	0.5761	0.4310	0.3118	0.2118	0.1464	0.1618	0.2692	0.4793	0.7325	0.8692	(94)
Useful gains	660.9362	691.6463	641.9935	529.8378	402.2774	266.2236	177.2049	185.4711	290.4875	450.0389	581.2287	637.5157	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	748.5635	724.8350	650.9921	531.1672	402.4220	266.2311	177.2054	185.4720	290.5269	452.0934	611.8637	740.6597	(97)
Space heating kWh	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(98a)
Space heating requirement - total per year (kWh/year)												195.5822	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												195.5822	
Space heating per m2										(98c) / (4) =		2.9411	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5760	10.4558	11.5760	11.2026	11.5760	11.2026	11.5760	11.5760	11.2026	11.5760	11.2026	11.5760	(231)
Lighting	19.0422	15.2763	13.7546	10.0772	7.7840	6.3596	7.1008	9.2299	11.9887	15.7298	17.7668	19.5714	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.8374	-25.0495	-40.6440	-51.2425	-60.2341	-57.9825	-57.0592	-51.4970	-42.0573	-30.6737	-18.2140	-13.3632	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.1177	-7.4452	-16.6195	-27.6808	-38.7105	-39.7745	-39.2119	-31.7414	-21.6778	-11.4252	-4.4487	-2.3730	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	195.5822	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2475.6013	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.2984	(230a)
Total electricity for the above, kWh/year	136.2984	(231)
Electricity for lighting (calculated in Appendix L)	153.6812	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-708.0805	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2253.0826	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	195.5822	16.4900	32.2515	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	16.4900	408.2267	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	136.2984	16.4900	22.4756	(249)
Energy for lighting	153.6812	16.4900	25.3420	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-463.8543	16.4900	-76.4896	
PV Unit electricity exported	-244.2261	5.5900	-13.6522	
Total			-90.1418	(252)
Total energy cost			398.1540	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2855	(257)
SAP value	79.1617	
SAP rating (Section 12)	79	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	195.5822	0.1606	31.4176	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2475.6013	0.1413	349.7834	(264)
Space and water heating			381.2010	(265)
Pumps, fans and electric keep-hot	136.2984	0.1387	18.9063	(267)
Energy for lighting	153.6812	0.1443	22.1809	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-463.8543	0.1323	-61.3768	
PV Unit electricity exported	-244.2261	0.1233	-30.1190	
Total			-91.4957	(269)
Total CO2, kg/year			330.7925	(272)
CO2 emissions per m2			4.9700	(273)
EI value			96.0246	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.5000	(1b)	x 2.4000	(2b) =	159.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		159.6000	(5)

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2. Ventilation rate

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m3 per hour

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery		
If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	43.9000	19.6900	24.2100	0.1400	3.3894	14.0000	338.9400	(29a)
Total net area of external elements Aum(A, m2)			43.9000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.7211			(33)
Party Wall 1			55.9300	0.0000	0.0000	20.0000	1118.6000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.5000			80.0000	5320.0000	(32d)
Party Ceiling 1			66.5000			80.0000	5320.0000	(32b)
Internal Wall 1			140.2900			9.0000	1262.6100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13437.1500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.0624 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.1600	0.0700	1.1312
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	22.1400	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.0392 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	30.7603 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.1032	16.1032	15.7675	14.7602	14.5923	13.9208	13.5851	13.5851	14.2566	15.0960	15.4317	15.2638	(38)
Heat transfer coeff	46.8636	46.8636	46.5278	45.5206	45.3527	44.6812	44.3454	44.3454	45.0169	45.8563	46.1921	46.0242	(39)
Average = Sum(39)m / 12 =												45.6325	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7047	0.7047	0.6997	0.6845	0.6820	0.6719	0.6668	0.6668	0.6769	0.6896	0.6946	0.6921	(40)
HLP (average)												0.6862	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.1583 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
83.0588	81.8106	79.9917	76.5116	73.9433	71.0793	69.4513	71.2564	73.2352	76.3103	79.8652	82.7406	(42a)

Hot water usage for baths

26.1000	25.7123	25.1665	24.1600	23.4064	22.5708	22.1194	22.6614	23.2516	24.1458	25.1729	26.0117	(42b)

Hot water usage for other uses

36.7327	35.3969	34.0612	32.7255	31.3897	30.0540	30.0540	31.3897	32.7255	34.0612	35.3969	36.7327	(42c)

Average daily hot water use (litres/day)		134.1695 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.8914	142.9198	139.2194	133.3971	128.7395	123.7040	121.6247	125.3076	129.2122	134.5173	140.4351	145.4849	(44)
Energy conte	231.0563	203.5159	213.9750	182.6139	173.3081	152.1085	147.0945	155.1570	159.3316	182.5387	200.0755	227.7943	(45)
Energy content (annual)										Total = Sum(45)m =		2228.5693	
Distribution loss (46)m = 0.15 x (45)m	34.6584	30.5274	32.0962	27.3921	25.9962	22.8163	22.0642	23.2735	23.8997	27.3808	30.0113	34.1691	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
										Total per year (kWh/year) = Sum(64)m =		2475.6013	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	93.6109	82.8294	87.9313	76.9623	74.4096	66.8193	65.6936	68.3743	69.2210	77.4788	82.7683	92.5262	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.7552	19.3227	15.7143	11.8967	8.8930	7.5078	8.1125	10.5449	14.1533	17.9709	20.9747	22.3598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	282.0814	285.0085	277.6323	261.9291	242.1067	223.4764	211.0302	208.1031	215.4793	231.1825	251.0049	269.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	(71)
Water heating gains (Table 5)													
	125.8211	123.2580	118.1873	106.8921	100.0129	92.8046	88.2978	91.9010	96.1402	104.1381	114.9560	124.3632	(72)
Total internal gains													
	522.9304	520.8621	504.8066	473.9908	444.2853	417.0615	400.7133	403.8217	419.0457	446.5643	480.2084	509.6310	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	11.8100	33.4622	0.6300	0.8270	0.7700	142.6869	(77)
Southwest	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(79)

Solar gains	237.8920	432.4913	618.4356	806.0340	893.6844	862.2965	841.6682	750.0695	663.6383	475.1307	292.8315	208.1992	(83)
Total gains	760.8224	953.3534	1123.2423	1280.0248	1337.9696	1279.3581	1242.3814	1153.8912	1082.6839	921.6950	773.0399	717.8302	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	79.6469	79.6469	80.2217	81.9968	82.3004	83.5373	84.1698	84.1698	82.9142	81.3965	80.8048	81.0996	
alpha	6.3098	6.3098	6.3481	6.4665	6.4867	6.5692	6.6113	6.6113	6.5276	6.4264	6.3870	6.4066	
util living area													
	0.8845	0.7655	0.6241	0.4641	0.3489	0.2724	0.2177	0.2383	0.3407	0.5560	0.7919	0.9054	(86)
MIT	20.7303	20.8890	20.9674	20.9952	20.9993	20.9999	21.0000	21.0000	20.9995	20.9880	20.8884	20.6918	(87)
Th 2	20.3367	20.3367	20.3411	20.3545	20.3568	20.3657	20.3702	20.3702	20.3612	20.3501	20.3456	20.3478	(88)
util rest of house													
	0.8685	0.7432	0.6000	0.4416	0.3272	0.2502	0.1952	0.2141	0.3143	0.5256	0.7669	0.8915	(89)
MIT 2	20.0414	20.2207	20.3088	20.3501	20.3562	20.3657	20.3702	20.3702	20.3609	20.3395	20.2318	20.0064	(90)
Living area fraction										fLA = Living area / (4) =		0.3370	(91)
MIT	20.2736	20.4459	20.5307	20.5675	20.5729	20.5794	20.5824	20.5824	20.5761	20.5580	20.4531	20.2374	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2736	20.4459	20.5307	20.5675	20.5729	20.5794	20.5824	20.5824	20.5761	20.5580	20.4531	20.2374	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8668	0.7469	0.6070	0.4491	0.3345	0.2577	0.2028	0.2222	0.3232	0.5354	0.7711	0.8889	(94)
Useful gains	659.5127	712.1003	681.7671	574.8005	447.5175	329.6864	251.9844	256.4141	349.9080	493.4880	596.1068	638.1040	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	767.3236	756.6545	694.6943	576.6309	447.7632	329.7195	251.9897	256.4237	350.0571	497.9093	639.9012	761.1189	(97)
Space heating kWh													
	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(98a)
Space heating requirement - total per year (kWh/year)												247.6148	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												247.6148	
Space heating per m2											(98c) / (4) =	3.7235	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement												

	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5760	10.4558	11.5760	11.2026	11.5760	11.2026	11.5760	11.5760	11.2026	11.5760	11.2026	11.5760	(231)
Lighting	19.0422	15.2763	13.7546	10.0772	7.7840	6.3596	7.1008	9.2299	11.9887	15.7298	17.7668	19.5714	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.3659	-24.1373	-40.6748	-53.4156	-62.3565	-58.8247	-58.3796	-51.5126	-41.7801	-29.4038	-16.9601	-12.3644	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.6228	-6.9252	-16.5691	-29.8250	-41.2999	-40.8780	-40.9539	-31.7592	-21.4223	-10.5980	-3.9084	-2.0636	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	247.6148	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2475.6013	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.2984	(230a)
Total electricity for the above, kWh/year	136.2984	(231)
Electricity for lighting (calculated in Appendix L)	153.6812	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-713.0011	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2300.1947	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	247.6148	25.1600	62.2999	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	25.1600	622.8613	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	136.2984	25.1600	34.2927	(249)
Energy for lighting	153.6812	25.1600	38.6662	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.1755	25.1600	-116.7865	
PV Unit electricity exported	-248.8256	5.8100	-14.4568	
Total			-131.2433	(252)
Total energy cost			626.8767	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	247.6148	0.1602	39.6760	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2475.6013	0.1413	349.7834	(264)
Space and water heating			389.4594	(265)
Pumps, fans and electric keep-hot	136.2984	0.1387	18.9063	(267)
Energy for lighting	153.6812	0.1443	22.1809	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.1755	0.1320	-61.2773	
PV Unit electricity exported	-248.8256	0.1228	-30.5608	
Total			-91.8382	(269)
Total CO2, kg/year			338.7085	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	

Space heating - main system 1	247.6148	1.5930	394.4398	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	1.5225	3769.0221	(278)
Space and water heating			4163.4620	(279)
Pumps, fans and electric keep-hot	136.2984	1.5128	206.1922	(281)
Energy for lighting	153.6812	1.5338	235.7213	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.1755	1.4878	-690.5810	
PV Unit electricity exported	-248.8256	0.4508	-112.1583	
Total			-802.7393	(283)
Total Primary energy kWh/year			3802.6362	(286)

Predicted Energy Assessment

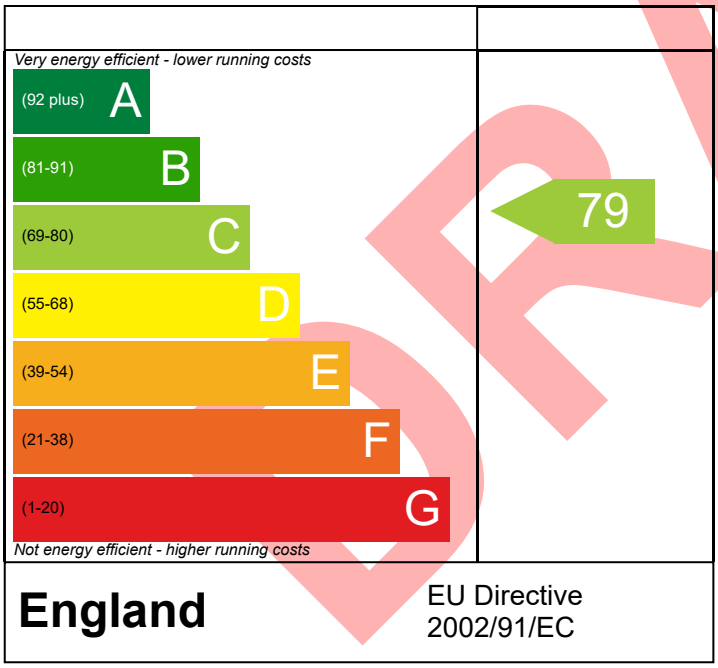
elmhurst energy

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	66.5 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

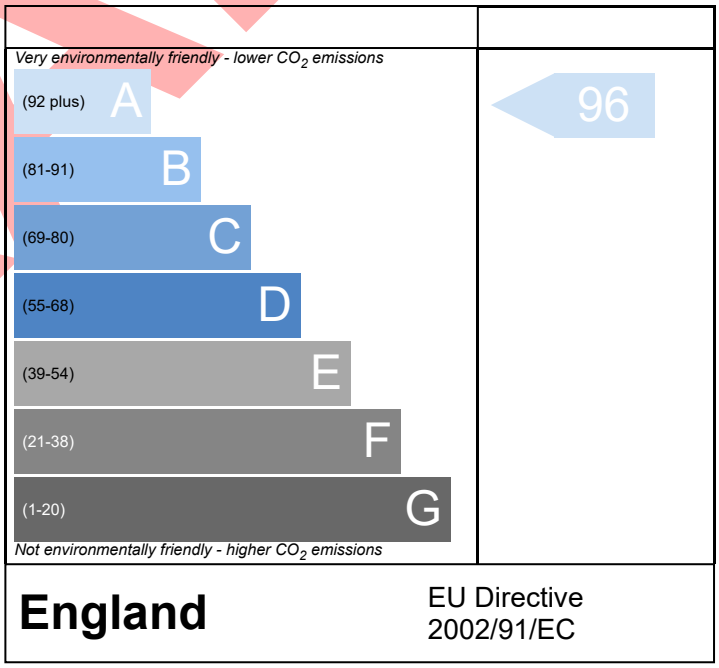
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:26

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	49 m^2
Site Reference	Unit 163 L05_Copy	Plot Reference	Unit 163 L05_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.77 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	5.62 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*64.09 kWh_{PE}/m^2*	
Dwelling primary energy	63.15 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*14.4 kWh/m^2*	
Dwelling fabric energy efficiency	13.7 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	7.88	0.14 **(!)**
Party wall: Party Wall (1)	24.84	0 **(!)**
Party wall: Party Wall (2)	39.01	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	6.29	North East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.63 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 163 L05_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 163 L05_Copy	**Prop Type Ref**	Unit 163 L05
Property			

SAP Rating	79 C	**DER**	5.62	**TER**	11.77
Environmental	96 A	**% DER < TER**			52.25
CO_2 Emissions (t/year)	0.27	**DFEE**	13.68	**TFEE**	14.36
Compliance Check	See BREL	**% DFEE < TFEE**			4.74
% DPER < TPER	1.47	**DPER**	63.15	**TPER**	64.09

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.8100	(1b)	x 2.4000	(2b) =	117.1440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.8100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		117.1440	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.2900	1.2357	7.7728			(27)
External Wall 1	14.1700	6.2900	7.8800	0.1400	1.1032	14.0000	110.3200	(29a)
Total net area of external elements Aum(A, m2)			14.1700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		8.8760			(33)
Party Wall 1			24.8400	0.0000	0.0000	20.0000	496.8000	(32)
Wall to corridor			39.0100	0.0000	0.0000	20.0000	780.2000	(32)
Party Floor 1			48.8100			80.0000	3904.8000	(32d)
Party Ceiling 1			48.8100			80.0000	3904.8000	(32b)
Internal Wall 1			72.6800			9.0000	654.1200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 9851.0400	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	201.8242	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.7100	0.0500	0.1355

E4 Jamb	9.2800	0.0500	0.4640	
E7 Party floor between dwellings (in blocks of flats)	5.2500	0.0700	0.3675	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	20.8400	0.0000	0.0000	
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.2910 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 10.1670 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.1418	11.0295	10.9171	10.3554	10.2430	9.6813	9.6813	9.5689	9.9060	10.2430	10.4677	10.6924	(38)
Heat transfer coeff	21.3088	21.1965	21.0841	20.5224	20.4100	19.8483	19.8483	19.7360	20.0730	20.4100	20.6347	20.8594	(39)
Average = Sum(39)m / 12 =												20.4943	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4366	0.4343	0.4320	0.4205	0.4182	0.4066	0.4066	0.4043	0.4112	0.4182	0.4228	0.4274	(40)
HLP (average)												0.4199	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6551 (42)
Hot water usage for mixer showers

71.4595	70.3856	68.8207	65.8266	63.6170	61.1529	59.7523	61.3053	63.0077	65.6534	68.7119	71.1857	(42a)

Hot water usage for baths

22.4723	22.1385	21.6685	20.8020	20.1531	19.4336	19.0450	19.5117	20.0198	20.7897	21.6741	22.3963	(42b)

Hot water usage for other uses

31.5802	30.4318	29.2834	28.1350	26.9867	25.8383	25.8383	26.9867	28.1350	29.2834	30.4318	31.5802	(42c)

Average daily hot water use (litres/day) 115.4278 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	125.5119	122.9558	119.7726	114.7636	110.7568	106.4248	104.6356	107.8037	111.1626	115.7265	120.8177	125.1621	(44)
Energy conte	198.7801	175.0875	184.0861	157.1056	149.0999	130.8617	126.5476	133.4834	137.0746	157.0398	172.1270	195.9736	(45)
Energy content (annual)											Total = Sum(45)m =	1917.2669	
Distribution loss (46)m = 0.15 x (45)m	29.8170	26.2631	27.6129	23.5658	22.3650	19.6293	18.9821	20.0225	20.5612	23.5560	25.8191	29.3960	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
										Total per year (kWh/year) = Sum(64)m =		2164.2989	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	82.8790	73.3769	77.9933	68.4808	66.3603	59.7547	58.8617	61.1679	61.8205	69.0004	73.4754	81.9459	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.4855	15.5304	12.6302	9.5619	7.1476	6.0343	6.5203	8.4753	11.3756	14.4439	16.8582	17.9715	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.1398	217.3723	211.7465	199.7699	184.6516	170.4425	160.9500	158.7175	164.3433	176.3199	191.4382	205.6473	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	(71)
Water heating gains (Table 5)	111.3965	109.1918	104.8296	95.1122	89.1940	82.9927	79.1152	82.2149	85.8618	92.7424	102.0492	110.1423	(72)
Total internal gains	423.7103	421.7830	408.8948	384.1325	360.6817	339.1579	326.2739	329.0962	341.2691	363.1946	390.0340	413.4494	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.2900	11.2829	0.6300	0.8270	0.7700	25.6243	(75)

Solar gains	25.6243	52.1590	93.9740	154.3323	207.4529	221.1667	206.8969	164.9406	114.5088	63.7425	32.2420	20.9261	(83)
Total gains	449.3346	473.9420	502.8688	538.4647	568.1345	560.3246	533.1709	494.0368	455.7778	426.9371	422.2760	434.3755	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	128.4162	129.0969	129.7848	133.3373	134.0712	137.8657	137.8657	138.6505	136.3224	134.0712	132.6113	131.1828	
alpha	9.5611	9.6065	9.6523	9.8892	9.9381	10.1910	10.1910	10.2434	10.0882	9.9381	9.8408	9.7455	
util living area													
	0.7726	0.7112	0.6060	0.4610	0.3341	0.2267	0.1638	0.1838	0.3039	0.4969	0.6743	0.7854	(86)
MIT	20.9734	20.9871	20.9970	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9997	20.9936	20.9715	(87)
Th 2	20.5793	20.5815	20.5836	20.5943	20.5964	20.6071	20.6071	20.6093	20.6028	20.5964	20.5921	20.5879	(88)
util rest of house													
	0.7562	0.6942	0.5890	0.4456	0.3196	0.2128	0.1492	0.1682	0.2864	0.4777	0.6555	0.7694	(89)
MIT 2	20.5513	20.5682	20.5806	20.5941	20.5964	20.6071	20.6071	20.6093	20.6028	20.5961	20.5859	20.5578	(90)
Living area fraction										fLA = Living area / (4) =		0.5530	(91)
MIT	20.7847	20.7999	20.8108	20.8184	20.8196	20.8244	20.8244	20.8253	20.8225	20.8193	20.8113	20.7866	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7847	20.7999	20.8108	20.8184	20.8196	20.8244	20.8244	20.8253	20.8225	20.8193	20.8113	20.7866	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7643	0.7031	0.5983	0.4541	0.3276	0.2205	0.1573	0.1768	0.2961	0.4883	0.6657	0.7772	(94)
Useful gains	343.4042	333.2384	300.8562	244.5404	186.1291	123.5433	83.8467	87.3382	134.9394	208.4897	281.0919	337.5907	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	351.2699	337.0213	301.7319	244.5949	186.1310	123.5433	83.8467	87.3382	134.9399	208.5761	282.9300	345.9870	(97)
Space heating kWh	5.8521	2.5421	0.6515	0.0392	0.0014	0.0000	0.0000	0.0000	0.0000	0.0643	1.3235	6.2469	(98a)
Space heating requirement - total per year (kWh/year)												16.7210	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	5.8521	2.5421	0.6515	0.0392	0.0014	0.0000	0.0000	0.0000	0.0000	0.0643	1.3235	6.2469	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												16.7210	
Space heating per m2											(98c) / (4) =	0.3426	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	5.8521	2.5421	0.6515	0.0392	0.0014	0.0000	0.0000	0.0000	0.0000	0.0643	1.3235	6.2469	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	5.8521	2.5421	0.6515	0.0392	0.0014	0.0000	0.0000	0.0000	0.0000	0.0643	1.3235	6.2469	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.4966	7.6744	8.4966	8.2225	8.4966	8.2225	8.4966	8.4966	8.2225	8.4966	8.2225	8.4966	(231)
Lighting	15.3049	12.2782	11.0551	8.0995	6.2563	5.1114	5.7072	7.4184	9.6358	12.6427	14.2798	15.7303	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.6124	-18.5300	-30.3052	-38.4596	-45.4028	-43.7828	-43.0940	-38.8073	-31.5720	-22.8790	-13.4504	-9.7805	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.2732	-5.2742	-11.6436	-19.3564	-27.0799	-27.8299	-27.4302	-22.1697	-15.1176	-7.9609	-3.1514	-1.7472	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												16.7210	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2164.2989	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)													
mechanical ventilation fans (SFP = 0.7000)												100.0410	(230a)
Total electricity for the above, kWh/year												100.0410	(231)
Electricity for lighting (calculated in Appendix L)												123.5196	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-518.7101	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)

Appendix Q - special features

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1885.8704	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	16.7210	16.4900	2.7573	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	16.4900	356.8929	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	100.0410	16.4900	16.4968	(249)
Energy for lighting	123.5196	16.4900	20.3684	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.6760	16.4900	-57.3318	
PV Unit electricity exported	-171.0341	5.5900	-9.5608	
Total			-66.8926	(252)
Total energy cost			329.6227	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2649	(257)
SAP value	79.4953	
SAP rating (Section 12)	79	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	16.7210	0.1611	2.6929	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2164.2989	0.1413	305.7097	(264)
Space and water heating			308.4027	(265)
Pumps, fans and electric keep-hot	100.0410	0.1387	13.8769	(267)
Energy for lighting	123.5196	0.1443	17.8277	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.6760	0.1322	-45.9596	
PV Unit electricity exported	-171.0341	0.1234	-21.1138	
Total			-67.0733	(269)
Total CO2, kg/year			273.0339	(272)
CO2 emissions per m2			5.5900	(273)
EI value			96.0999	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.8100	(1b)	x 2.4000	(2b) =	117.1440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 48.8100						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		117.1440	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor (20) = 1 - [0.075 x (19)] =		0.7750	(20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.2900	1.2357	7.7728			(27)
External Wall 1	14.1700	6.2900	7.8800	0.1400	1.1032	14.0000	110.3200	(29a)
Total net area of external elements Aum(A, m2)			14.1700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	8.8760			(33)
Party Wall 1			24.8400	0.0000	0.0000	20.0000	496.8000	(32)
Wall to corridor			39.0100	0.0000	0.0000	20.0000	780.2000	(32)
Party Floor 1			48.8100			80.0000	3904.8000	(32d)
Party Ceiling 1			48.8100			80.0000	3904.8000	(32b)
Internal Wall 1			72.6800			9.0000	654.1200	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9851.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 201.8242 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.7100	0.0500	0.1355
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.2500	0.0700	0.3675
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	20.8400	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.2910 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 10.1670 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.2542	11.2542	11.0295	10.3554	10.2430	9.7936	9.5689	9.5689	10.0183	10.5801	10.8048	10.6924	(38)
Heat transfer coeff	21.4212	21.4212	21.1965	20.5224	20.4100	19.9607	19.7360	19.7360	20.1854	20.7471	20.9718	20.8594	(39)

Average = Sum(39)m / 12 = 20.5973

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4389	0.4389	0.4343	0.4205	0.4182	0.4089	0.4043	0.4043	0.4135	0.4251	0.4297	0.4274	(40)
HLP (average)												0.4220	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6551 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	71.4595	70.3856	68.8207	65.8266	63.6170	61.1529	59.7523	61.3053	63.0077	65.6534	68.7119	71.1857	(42a)
Hot water usage for baths	22.4723	22.1385	21.6685	20.8020	20.1531	19.4336	19.0450	19.5117	20.0198	20.7897	21.6741	22.3963	(42b)
Hot water usage for other uses	31.5802	30.4318	29.2834	28.1350	26.9867	25.8383	25.8383	26.9867	28.1350	29.2834	30.4318	31.5802	(42c)

Average daily hot water use (litres/day) 115.4278 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	125.5119	122.9558	119.7726	114.7636	110.7568	106.4248	104.6356	107.8037	111.1626	115.7265	120.8177	125.1621	(44)
Energy conte	198.7801	175.0875	184.0861	157.1056	149.0999	130.8617	126.5476	133.4834	137.0746	157.0398	172.1270	195.9736	(45)

Energy content (annual) Total = Sum(45)m = 1917.2669

Distribution loss (46)m = 0.15 x (45)m	29.8170	26.2631	27.6129	23.5658	22.3650	19.6293	18.9821	20.0225	20.5612	23.5560	25.8191	29.3960	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)

Total per year (kWh/year) = Sum(64)m = 2164.2989 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	82.8790	73.3769	77.9933	68.4808	66.3603	59.7547	58.8617	61.1679	61.8205	69.0004	73.4754	81.9459	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	17.4855	15.5304	12.6302	9.5619	7.1476	6.0343	6.5203	8.4753	11.3756	14.4439	16.8582	17.9715	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	215.1398	217.3723	211.7465	199.7699	184.6516	170.4425	160.9500	158.7175	164.3433	176.3199	191.4382	205.6473	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	(71)

Water heating gains (Table 5)

	111.3965	109.1918	104.8296	95.1122	89.1940	82.9927	79.1152	82.2149	85.8618	92.7424	102.0492	110.1423	(72)

Total internal gains

	423.7103	421.7830	408.8948	384.1325	360.6817	339.1579	326.2739	329.0962	341.2691	363.1946	390.0340	413.4494	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.2900	10.0309	0.6300	0.8270	0.7700	22.7809	(75)

Solar gains	22.7809	49.3199	92.7016	160.6228	214.7931	223.1785	211.1088	162.9125	112.0170	59.8425	29.4243	19.0490	(83)
Total gains	446.4911	471.1029	501.5964	544.7552	575.4748	562.3364	537.3828	492.0087	453.2861	423.0371	419.4582	432.4984	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	127.7427	127.7427	129.0969	133.3373	134.0712	137.0897	138.6505	138.6505	135.5637	131.8932	130.4800	131.1828	
alpha	9.5162	9.5162	9.6065	9.8892	9.9381	10.1393	10.2434	10.2434	10.0376	9.7929	9.6987	9.7455	
util living area	0.7948	0.7453	0.6471	0.4933	0.3653	0.2769	0.2240	0.2487	0.3651	0.5534	0.7114	0.8068	(86)
MIT	20.9651	20.9797	20.9943	20.9996	21.0000	21.0000	21.0000	21.0000	21.0000	20.9990	20.9890	20.9634	(87)
Th 2	20.5772	20.5772	20.5815	20.5943	20.5964	20.6050	20.6093	20.6093	20.6007	20.5900	20.5857	20.5879	(88)
util rest of house	0.7789	0.7287	0.6302	0.4781	0.3510	0.2628	0.2097	0.2330	0.3474	0.5335	0.6926	0.7915	(89)
MIT 2	20.5401	20.5560	20.5757	20.5939	20.5964	20.6050	20.6093	20.6093	20.6007	20.5891	20.5747	20.5487	(90)
Living area fraction										fLA = Living area / (4) =		0.5530	(91)
MIT	20.7751	20.7903	20.8072	20.8182	20.8196	20.8234	20.8253	20.8253	20.8215	20.8158	20.8038	20.7780	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7751	20.7903	20.8072	20.8182	20.8196	20.8234	20.8253	20.8253	20.8215	20.8158	20.8038	20.7780	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7864	0.7371	0.6393	0.4865	0.3589	0.2706	0.2176	0.2417	0.3572	0.5445	0.7025	0.7986	(94)
Useful gains	351.1385	347.2445	320.6771	265.0035	206.5358	152.1681	116.9421	118.9157	161.9131	230.3437	294.6735	345.4051	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	361.4839	353.2416	322.3390	265.1134	206.5408	152.1683	116.9421	118.9157	161.9165	230.6198	297.8783	356.2377	(97)
Space heating kWh	7.6970	4.0300	1.2365	0.0791	0.0037	0.0000	0.0000	0.0000	0.0000	0.2055	2.3075	8.0594	(98a)
Space heating requirement - total per year (kWh/year)												23.6187	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	7.6970	4.0300	1.2365	0.0791	0.0037	0.0000	0.0000	0.0000	0.0000	0.2055	2.3075	8.0594	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												23.6187	
Space heating per m2										(98c) / (4) =		0.4839	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	7.6970	4.0300	1.2365	0.0791	0.0037	0.0000	0.0000	0.0000	0.0000	0.2055	2.3075	8.0594	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	7.6970	4.0300	1.2365	0.0791	0.0037	0.0000	0.0000	0.0000	0.0000	0.2055	2.3075	8.0594	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating

Water heating requirement	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(219)

Space cooling fuel requirement

(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.4966	7.6744	8.4966	8.2225	8.4966	8.2225	8.4966	8.4966	8.2225	8.4966	8.2225	8.4966	(231)
Lighting	15.3049	12.2782	11.0551	8.0995	6.2563	5.1114	5.7072	7.4184	9.6358	12.6427	14.2798	15.7303	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.5135	-17.8235	-30.3039	-40.1107	-47.0328	-44.4324	-44.1129	-38.8193	-31.3606	-21.9085	-12.4971	-9.0348	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.9317	-4.9317	-11.6305	-20.8679	-28.9016	-28.6057	-28.6546	-22.1822	-14.9388	-7.3951	-2.7904	-1.5346	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	23.6187	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2164.2989	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	100.0410	(230a)
Total electricity for the above, kWh/year	100.0410	(231)
Electricity for lighting (calculated in Appendix L)	123.5196	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-522.3147	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1889.1634	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	23.6187	25.1600	5.9425	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	25.1600	544.5376	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	100.0410	25.1600	25.1703	(249)
Energy for lighting	123.5196	25.1600	31.0775	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.9499	25.1600	-87.5442	
PV Unit electricity exported	-174.3648	5.8100	-10.1306	
Total			-97.6748	(252)
Total energy cost			509.0531	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	23.6187	0.1605	3.7905	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2164.2989	0.1413	305.7097	(264)
Space and water heating			309.5002	(265)
Pumps, fans and electric keep-hot	100.0410	0.1387	13.8769	(267)
Energy for lighting	123.5196	0.1443	17.8277	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.9499	0.1319	-45.8876	
PV Unit electricity exported	-174.3648	0.1230	-21.4411	
Total			-67.3287	(269)
Total CO2, kg/year			273.8761	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	23.6187	1.5940	37.6472	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	1.5223	3294.7406	(278)
Space and water heating			3332.3878	(279)
Pumps, fans and electric keep-hot	100.0410	1.5128	151.3420	(281)
Energy for lighting	123.5196	1.5338	189.4585	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.9499	1.4873	-517.4911	
PV Unit electricity exported	-174.3648	0.4513	-78.6883	
Total			-596.1795	(283)
Total Primary energy kWh/year			3077.0088	(286)

SAP 10 EPC IMPROVEMENTS

Unit 163 L05_Copy

Current energy efficiency rating: C 79
Current environmental impact rating: A 96

N Solar water heating — Not applicable
U Solar photovoltaic panels — Not applicable
V2 Wind turbine — Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 79
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£607	£607	£0
Space heating	£31	£31	£0
Water heating	£545	£545	£0
Lighting	£31	£31	£0
Generated (PV)	-£98	-£98	£0
Total cost of fuels	£509	£509	£0
Total cost of uses	£509	£509	£0
Delivered energy	39 kWh/m²	39 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	63 kWh/m²	63 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.8100	(1b)	x 2.4000	(2b) =	117.1440	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.8100					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		117.1440	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation: 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a): 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.2900	1.2357	7.7728			(27)
External Wall 1	14.1700	6.2900	7.8800	0.1400	1.1032	14.0000	110.3200	(29a)
Total net area of external elements Aum(A, m2)			14.1700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	8.8760			(33)
Party Wall 1			24.8400	0.0000	0.0000	20.0000	496.8000	(32)
Wall to corridor			39.0100	0.0000	0.0000	20.0000	780.2000	(32)
Party Floor 1			48.8100			80.0000	3904.8000	(32d)
Party Ceiling 1			48.8100			80.0000	3904.8000	(32b)
Internal Wall 1			72.6800			9.0000	654.1200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9851.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		201.8242 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.7100	0.0500	0.1355
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.2500	0.0700	0.3675
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	20.8400	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.2910 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	10.1670 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.1418	11.0295	10.9171	10.3554	10.2430	9.6813	9.6813	9.5689	9.9060	10.2430	10.4677	10.6924	(38)
Heat transfer coeff	21.3088	21.1965	21.0841	20.5224	20.4100	19.8483	19.8483	19.7360	20.0730	20.4100	20.6347	20.8594	(39)
Average = Sum(39)m / 12 =												20.4943	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4366	0.4343	0.4320	0.4205	0.4182	0.4066	0.4066	0.4043	0.4112	0.4182	0.4228	0.4274	(40)
HLP (average)												0.4199	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.6551 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
71.4595	70.3856	68.8207	65.8266	63.6170	61.1529	59.7523	61.3053	63.0077	65.6534	68.7119	71.1857	(42a)

Hot water usage for baths

22.4723	22.1385	21.6685	20.8020	20.1531	19.4336	19.0450	19.5117	20.0198	20.7897	21.6741	22.3963	(42b)

Hot water usage for other uses

31.5802	30.4318	29.2834	28.1350	26.9867	25.8383	25.8383	26.9867	28.1350	29.2834	30.4318	31.5802	(42c)

Average daily hot water use (litres/day)		115.4278 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	125.5119	122.9558	119.7726	114.7636	110.7568	106.4248	104.6356	107.8037	111.1626	115.7265	120.8177	125.1621	(44)
Energy conte	198.7801	175.0875	184.0861	157.1056	149.0999	130.8617	126.5476	133.4834	137.0746	157.0398	172.1270	195.9736	(45)
Energy content (annual)										Total = Sum(45)m =		1917.2669	

Distribution loss (46)m = 0.15 x (45)m

29.8170	26.2631	27.6129	23.5658	22.3650	19.6293	18.9821	20.0225	20.5612	23.5560	25.8191	29.3960	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
									Total per year (kWh/year) = Sum(64)m =		2164.2989	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

82.8790	73.3769	77.9933	68.4808	66.3603	59.7547	58.8617	61.1679	61.8205	69.0004	73.4754	81.9459	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	17.4855	15.5304	12.6302	9.5619	7.1476	6.0343	6.5203	8.4753	11.3756	14.4439	16.8582	17.9715	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	215.1398	217.3723	211.7465	199.7699	184.6516	170.4425	160.9500	158.7175	164.3433	176.3199	191.4382	205.6473	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	(71)
Water heating gains (Table 5)													
	111.3965	109.1918	104.8296	95.1122	89.1940	82.9927	79.1152	82.2149	85.8618	92.7424	102.0492	110.1423	(72)
Total internal gains													
	423.7103	421.7830	408.8948	384.1325	360.6817	339.1579	326.2739	329.0962	341.2691	363.1946	390.0340	413.4494	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.2900	11.2829	0.6300	0.8270	0.7700	25.6243	(75)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	25.6243	52.1590	93.9740	154.3323	207.4529	221.1667	206.8969	164.9406	114.5088	63.7425	32.2420	20.9261	(83)
Total gains	449.3346	473.9420	502.8688	538.4647	568.1345	560.3246	533.1709	494.0368	455.7778	426.9371	422.2760	434.3755	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	128.4162	129.0969	129.7848	133.3373	134.0712	137.8657	137.8657	138.6505	136.3224	134.0712	132.6113	131.1828	
alpha	9.5611	9.6065	9.6523	9.8892	9.9381	10.1910	10.1910	10.2434	10.0882	9.9381	9.8408	9.7455	
util living area	0.7726	0.7112	0.6060	0.4610	0.3341	0.2267	0.1638	0.1838	0.3039	0.4969	0.6743	0.7854	(86)
MIT	20.9734	20.9871	20.9970	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9997	20.9936	20.9715	(87)
Th 2	20.5793	20.5815	20.5836	20.5943	20.5964	20.6071	20.6071	20.6093	20.6028	20.5964	20.5921	20.5879	(88)
util rest of house	0.7562	0.6942	0.5890	0.4456	0.3196	0.2128	0.1492	0.1682	0.2864	0.4777	0.6555	0.7694	(89)
MIT 2	20.5513	20.5682	20.5806	20.5941	20.5964	20.6071	20.6071	20.6093	20.6028	20.5961	20.5859	20.5578	(90)
Living area fraction										fLA = Living area / (4) =		0.5530	(91)
MIT	20.7847	20.7999	20.8108	20.8184	20.8196	20.8244	20.8244	20.8253	20.8225	20.8193	20.8113	20.7866	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7847	20.7999	20.8108	20.8184	20.8196	20.8244	20.8244	20.8253	20.8225	20.8193	20.8113	20.7866	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7643	0.7031	0.5983	0.4541	0.3276	0.2205	0.1573	0.1768	0.2961	0.4883	0.6657	0.7772	(94)
Useful gains	343.4042	333.2384	300.8562	244.5404	186.1291	123.5433	83.8467	87.3382	134.9394	208.4897	281.0919	337.5907	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	351.2699	337.0213	301.7319	244.5949	186.1310	123.5433	83.8467	87.3382	134.9399	208.5761	282.9300	345.9870	(97)
Space heating kWh	5.8521	2.5421	0.6515	0.0392	0.0014	0.0000	0.0000	0.0000	0.0000	0.0643	1.3235	6.2469	(98a)
Space heating requirement - total per year (kWh/year)												16.7210	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	5.8521	2.5421	0.6515	0.0392	0.0014	0.0000	0.0000	0.0000	0.0000	0.0643	1.3235	6.2469	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												16.7210	
Space heating per m2										(98c) / (4) =		0.3426	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	5.8521	2.5421	0.6515	0.0392	0.0014	0.0000	0.0000	0.0000	0.0000	0.0643	1.3235	6.2469	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	5.8521	2.5421	0.6515	0.0392	0.0014	0.0000	0.0000	0.0000	0.0000	0.0643	1.3235	6.2469	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.4966	7.6744	8.4966	8.2225	8.4966	8.2225	8.4966	8.4966	8.2225	8.4966	8.2225	8.4966	(231)
Lighting	15.3049	12.2782	11.0551	8.0995	6.2563	5.1114	5.7072	7.4184	9.6358	12.6427	14.2798	15.7303	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.6124	-18.5300	-30.3052	-38.4596	-45.4028	-43.7828	-43.0940	-38.8073	-31.5720	-22.8790	-13.4504	-9.7805	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.2732	-5.2742	-11.6436	-19.3564	-27.0799	-27.8299	-27.4302	-22.1697	-15.1176	-7.9609	-3.1514	-1.7472	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	16.7210	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2164.2989	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	100.0410	(230a)
Total electricity for the above, kWh/year	100.0410	(231)
Electricity for lighting (calculated in Appendix L)	123.5196	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-518.7101	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1885.8704	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	16.7210	16.4900	2.7573	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	16.4900	356.8929	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	100.0410	16.4900	16.4968	(249)
Energy for lighting	123.5196	16.4900	20.3684	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.6760	16.4900	-57.3318	
PV Unit electricity exported	-171.0341	5.5900	-9.5608	
Total			-66.8926	(252)
Total energy cost			329.6227	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2649	(257)
SAP value	79.4953	
SAP rating (Section 12)	79	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	16.7210	0.1611	2.6929	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2164.2989	0.1413	305.7097	(264)
Space and water heating			308.4027	(265)
Pumps, fans and electric keep-hot	100.0410	0.1387	13.8769	(267)
Energy for lighting	123.5196	0.1443	17.8277	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.6760	0.1322	-45.9596	
PV Unit electricity exported	-171.0341	0.1234	-21.1138	
Total			-67.0733	(269)
Total CO2, kg/year			273.0339	(272)
CO2 emissions per m2			5.5900	(273)
EI value			96.0999	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.8100	(1b)	x 2.4000	(2b) =	117.1440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.8100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		117.1440	(5)

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2. Ventilation rate

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m3 per hour

Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												72.0000	(23c)
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.2900	1.2357	7.7728			(27)
External Wall 1	14.1700	6.2900	7.8800	0.1400	1.1032	14.0000	110.3200	(29a)
Total net area of external elements Aum(A, m2)			14.1700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		8.8760			(33)
Party Wall 1			24.8400	0.0000	0.0000	20.0000	496.8000	(32)
Wall to corridor			39.0100	0.0000	0.0000	20.0000	780.2000	(32)
Party Floor 1			48.8100			80.0000	3904.8000	(32d)
Party Ceiling 1			48.8100			80.0000	3904.8000	(32b)
Internal Wall 1			72.6800			9.0000	654.1200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9851.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		201.8242 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.7100	0.0500	0.1355
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.2500	0.0700	0.3675
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	20.8400	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.2910 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	10.1670 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.2542	11.2542	11.0295	10.3554	10.2430	9.7936	9.5689	9.5689	10.0183	10.5801	10.8048	10.6924	(38)
Heat transfer coeff	21.4212	21.4212	21.1965	20.5224	20.4100	19.9607	19.7360	19.7360	20.1854	20.7471	20.9718	20.8594	(39)
Average = Sum(39)m / 12 =												20.5973	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4389	0.4389	0.4343	0.4205	0.4182	0.4089	0.4043	0.4043	0.4135	0.4251	0.4297	0.4274	(40)
HLP (average)												0.4220	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.6551 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
71.4595	70.3856	68.8207	65.8266	63.6170	61.1529	59.7523	61.3053	63.0077	65.6534	68.7119	71.1857	(42a)

Hot water usage for baths

22.4723	22.1385	21.6685	20.8020	20.1531	19.4336	19.0450	19.5117	20.0198	20.7897	21.6741	22.3963	(42b)

Hot water usage for other uses

31.5802	30.4318	29.2834	28.1350	26.9867	25.8383	25.8383	26.9867	28.1350	29.2834	30.4318	31.5802	(42c)

Average daily hot water use (litres/day)		115.4278 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	125.5119	122.9558	119.7726	114.7636	110.7568	106.4248	104.6356	107.8037	111.1626	115.7265	120.8177	125.1621	(44)
Energy conte	198.7801	175.0875	184.0861	157.1056	149.0999	130.8617	126.5476	133.4834	137.0746	157.0398	172.1270	195.9736	(45)
Energy content (annual)										Total = Sum(45)m =		1917.2669	
Distribution loss (46)m = 0.15 x (45)m													
	29.8170	26.2631	27.6129	23.5658	22.3650	19.6293	18.9821	20.0225	20.5612	23.5560	25.8191	29.3960	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544 (64)
									Total per year (kWh/year) = Sum(64)m =			2164.2989 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						0.0000 (64a)
Heat gains from water heating, kWh/month												
	82.8790	73.3769	77.9933	68.4808	66.3603	59.7547	58.8617	61.1679	61.8205	69.0004	73.4754	81.9459 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	17.4855	15.5304	12.6302	9.5619	7.1476	6.0343	6.5203	8.4753	11.3756	14.4439	16.8582	17.9715	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	215.1398	217.3723	211.7465	199.7699	184.6516	170.4425	160.9500	158.7175	164.3433	176.3199	191.4382	205.6473	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	(71)
Water heating gains (Table 5)													
	111.3965	109.1918	104.8296	95.1122	89.1940	82.9927	79.1152	82.2149	85.8618	92.7424	102.0492	110.1423	(72)
Total internal gains													
	423.7103	421.7830	408.8948	384.1325	360.6817	339.1579	326.2739	329.0962	341.2691	363.1946	390.0340	413.4494	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.2900	10.0309	0.6300	0.8270	0.7700	22.7809	(75)

Solar gains	22.7809	49.3199	92.7016	160.6228	214.7931	223.1785	211.1088	162.9125	112.0170	59.8425	29.4243	19.0490	(83)
Total gains	446.4911	471.1029	501.5964	544.7552	575.4748	562.3364	537.3828	492.0087	453.2861	423.0371	419.4582	432.4984	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	127.7427	127.7427	129.0969	133.3373	134.0712	137.0897	138.6505	138.6505	135.5637	131.8932	130.4800	131.1828	
alpha	9.5162	9.5162	9.6065	9.8892	9.9381	10.1393	10.2434	10.2434	10.0376	9.7929	9.6987	9.7455	
util living area													
	0.7948	0.7453	0.6471	0.4933	0.3653	0.2769	0.2240	0.2487	0.3651	0.5534	0.7114	0.8068	(86)
MIT	20.9651	20.9797	20.9943	20.9996	21.0000	21.0000	21.0000	21.0000	21.0000	20.9990	20.9890	20.9634	(87)
Th 2	20.5772	20.5772	20.5815	20.5943	20.5964	20.6050	20.6093	20.6093	20.6007	20.5900	20.5857	20.5879	(88)
util rest of house													
	0.7789	0.7287	0.6302	0.4781	0.3510	0.2628	0.2097	0.2330	0.3474	0.5335	0.6926	0.7915	(89)
MIT 2	20.5401	20.5560	20.5757	20.5939	20.5964	20.6050	20.6093	20.6093	20.6007	20.5891	20.5747	20.5487	(90)
Living area fraction										fLA = Living area / (4) =		0.5530	(91)
MIT	20.7751	20.7903	20.8072	20.8182	20.8196	20.8234	20.8253	20.8253	20.8215	20.8158	20.8038	20.7780	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7751	20.7903	20.8072	20.8182	20.8196	20.8234	20.8253	20.8253	20.8215	20.8158	20.8038	20.7780	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7864	0.7371	0.6393	0.4865	0.3589	0.2706	0.2176	0.2417	0.3572	0.5445	0.7025	0.7986	(94)
Useful gains	351.1385	347.2445	320.6771	265.0035	206.5358	152.1681	116.9421	118.9157	161.9131	230.3437	294.6735	345.4051	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	361.4839	353.2416	322.3390	265.1134	206.5408	152.1683	116.9421	118.9157	161.9165	230.6198	297.8783	356.2377	(97)
Space heating kWh													
	7.6970	4.0300	1.2365	0.0791	0.0037	0.0000	0.0000	0.0000	0.0000	0.2055	2.3075	8.0594	(98a)
Space heating requirement - total per year (kWh/year)												23.6187	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	7.6970	4.0300	1.2365	0.0791	0.0037	0.0000	0.0000	0.0000	0.0000	0.2055	2.3075	8.0594	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												23.6187	
Space heating per m2											(98c) / (4) =	0.4839	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement												

	7.6970	4.0300	1.2365	0.0791	0.0037	0.0000	0.0000	0.0000	0.0000	0.2055	2.3075	8.0594 (98)
Space heating efficiency (main heating system 1)												
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)												
	7.6970	4.0300	1.2365	0.0791	0.0037	0.0000	0.0000	0.0000	0.0000	0.2055	2.3075	8.0594 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	8.4966	7.6744	8.4966	8.2225	8.4966	8.2225	8.4966	8.4966	8.2225	8.4966	8.2225	8.4966 (231)
Lighting	15.3049	12.2782	11.0551	8.0995	6.2563	5.1114	5.7072	7.4184	9.6358	12.6427	14.2798	15.7303 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-10.5135	-17.8235	-30.3039	-40.1107	-47.0328	-44.4324	-44.1129	-38.8193	-31.3606	-21.9085	-12.4971	-9.0348 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-1.9317	-4.9317	-11.6305	-20.8679	-28.9016	-28.6057	-28.6546	-22.1822	-14.9388	-7.3951	-2.7904	-1.5346 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	23.6187 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2164.2989 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	100.0410 (230a)
Total electricity for the above, kWh/year	100.0410 (231)
Electricity for lighting (calculated in Appendix L)	123.5196 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-522.3147 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1889.1634 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	23.6187	25.1600	5.9425	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	25.1600	544.5376	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	100.0410	25.1600	25.1703	(249)
Energy for lighting	123.5196	25.1600	31.0775	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.9499	25.1600	-87.5442	
PV Unit electricity exported	-174.3648	5.8100	-10.1306	
Total			-97.6748	(252)
Total energy cost			509.0531	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	23.6187	0.1605	3.7905	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2164.2989	0.1413	305.7097	(264)
Space and water heating			309.5002	(265)
Pumps, fans and electric keep-hot	100.0410	0.1387	13.8769	(267)
Energy for lighting	123.5196	0.1443	17.8277	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.9499	0.1319	-45.8876	
PV Unit electricity exported	-174.3648	0.1230	-21.4411	
Total			-67.3287	(269)
Total CO2, kg/year			273.8761	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year

Space heating - main system 1	23.6187	1.5940	37.6472	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	1.5223	3294.7406	(278)
Space and water heating			3332.3878	(279)
Pumps, fans and electric keep-hot	100.0410	1.5128	151.3420	(281)
Energy for lighting	123.5196	1.5338	189.4585	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.9499	1.4873	-517.4911	
PV Unit electricity exported	-174.3648	0.4513	-78.6883	
Total			-596.1795	(283)
Total Primary energy kWh/year			3077.0088	(286)

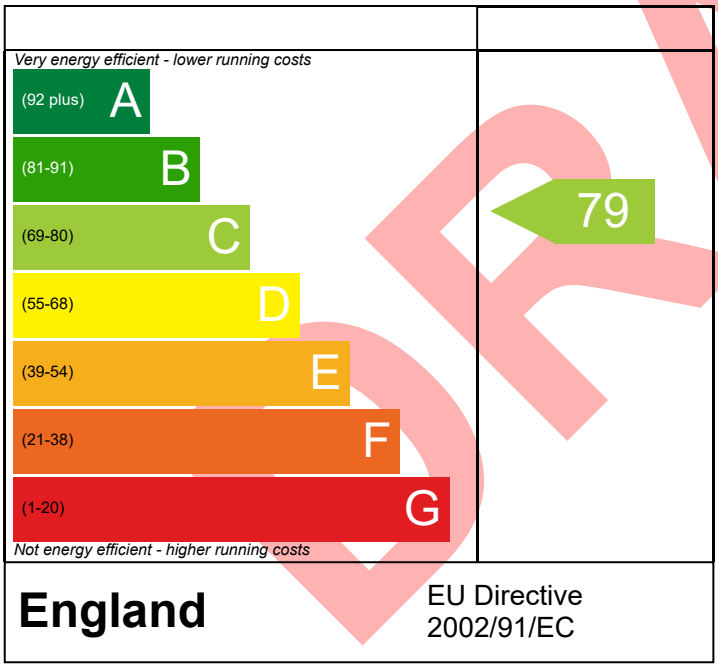
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	48.81 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

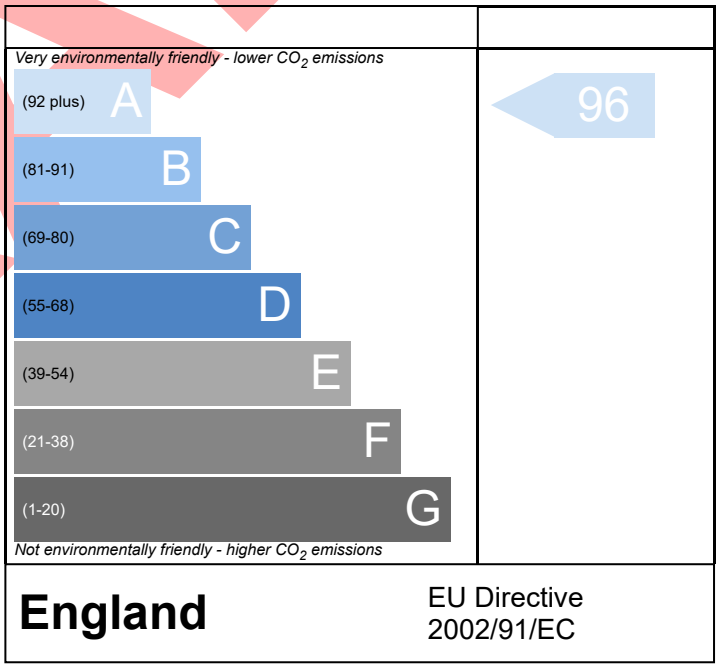
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:27

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	51 m^2
Site Reference	Unit 164 L05_Copy	Plot Reference	Unit 164 L05_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.09 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	5.38 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*60.3 kWh_{PE}/m^2*	
Dwelling primary energy	60.59 kWh_{PE}/m^2	FAIL
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*12.7 kWh/m^2*	
Dwelling fabric energy efficiency	11.8 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	7.91	0.14 **(!)**
Party wall: Party Wall (1)	47.52	0 **(!)**
Party wall: Party Wall (2)	15.79	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SE, Opening Type 1	7.88	South East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.67 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 164 L05_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 164 L05_Copy	**Prop Type Ref**	Unit 164 L05
Property			

SAP Rating	80 C	**DER**	5.38	**TER**	11.09
Environmental	96 A	**% DER < TER**			51.49
CO_2 Emissions (t/year)	0.28	**DFEE**	11.77	**TFEE**	12.71
Compliance Check	See BREL	**% DFEE < TFEE**			7.41
% DPER < TPER	-0.48	**DPER**	60.59	**TPER**	60.30

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.4800 (1b)	x	2.4000 (2b)	=	123.5520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.4800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	123.5520	(5)

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2. Ventilation rate

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	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	15.7900	7.8800	7.9100	0.1400	1.1074	14.0000	110.7400	(29a)
Total net area of external elements Aum(A, m2)			15.7900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.8450			(33)
Party Wall 1			47.5200	0.0000	0.0000	20.0000	950.4000	(32)
Wall to corridor			15.7900	0.0000	0.0000	20.0000	315.8000	(32)
Party Floor 1			51.4800			80.0000	4118.4000	(32d)
Party Ceiling 1			51.4800			80.0000	4118.4000	(32b)
Internal Wall 1			80.1900			9.0000	721.7100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 10335.4500	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	200.7663	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695

E4 Jamb	9.2800	0.0500	0.4640	
E7 Party floor between dwellings (in blocks of flats)	5.8500	0.0700	0.4095	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.4500	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.3670 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 12.2120 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.7513	11.6328	11.5143	10.9218	10.8033	10.2109	10.2109	10.0924	10.4479	10.8033	11.0403	11.2773	(38)
Heat transfer coeff	23.9633	23.8448	23.7264	23.1339	23.0154	22.4229	22.4229	22.3044	22.6599	23.0154	23.2524	23.4894	(39)

Average = Sum(39)m / 12 = 23.1043

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4655	0.4632	0.4609	0.4494	0.4471	0.4356	0.4356	0.4333	0.4402	0.4471	0.4517	0.4563	(40)
HLP (average)												0.4488	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7337 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.2716	72.1705	70.5659	67.4959	65.2303	62.7037	61.2676	62.8600	64.6056	67.3184	70.4543	72.9909	(42a)
Hot water usage for baths	23.0390	22.6968	22.2150	21.3266	20.6614	19.9237	19.5253	20.0037	20.5247	21.3140	22.2207	22.9611	(42b)
Hot water usage for other uses	32.3851	31.2075	30.0298	28.8522	27.6746	26.4969	26.4969	27.6746	28.8522	30.0298	31.2075	32.3851	(42c)

Average daily hot water use (litres/day) 118.3558 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.6957	126.0748	122.8108	117.6747	113.5662	109.1243	107.2898	110.5383	113.9825	118.6622	123.8825	128.3371	(44)
Energy conte	203.8226	179.5288	188.7556	161.0907	152.8819	134.1811	129.7577	136.8695	140.5518	161.0235	176.4934	200.9449	(45)

Energy content (annual) Total = Sum(45)m = 1965.9015

Distribution loss (46)m = 0.15 x (45)m	30.5734	26.9293	28.3133	24.1636	22.9323	20.1272	19.4636	20.5304	21.0828	24.1535	26.4740	30.1417	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)

Total per year (kWh/year) = Sum(64)m = 2212.9335 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	84.5557	74.8537	79.5459	69.8059	67.6179	60.8584	59.9291	62.2937	62.9767	70.3250	74.9273	83.5988	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.7487	15.7643	12.8204	9.7058	7.2552	6.1252	6.6185	8.6029	11.5468	14.6613	17.1120	18.2420	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	225.4877	227.8276	221.9312	209.3786	193.5331	178.6406	168.6914	166.3516	172.2479	184.8006	200.6461	215.5386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	(71)
Water heating gains (Table 5)	113.6501	111.3894	106.9165	96.9526	90.8842	84.5256	80.5498	83.7281	87.4676	94.5228	104.0656	112.3640	(72)
Total internal gains	438.6972	436.7919	423.4788	397.8477	373.4832	351.1020	337.6704	340.4934	353.0731	375.7954	403.6344	427.9553	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(77)

Solar gains	104.6841	178.3157	243.9793	302.3022	338.6036	336.1550	324.0893	297.0068	264.1780	197.0768	125.3874	89.5877	(83)
Total gains	543.3813	615.1076	667.4580	700.1498	712.0869	687.2570	661.7597	637.5001	617.2510	572.8722	529.0217	517.5431	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	119.8063	120.4016	121.0029	124.1019	124.7408	128.0368	128.0368	128.7170	126.6977	124.7408	123.4694	122.2237	
alpha	8.9871	9.0268	9.0669	9.2735	9.3161	9.5358	9.5358	9.5811	9.4465	9.3161	9.2313	9.1482	
util living area													
	0.7234	0.6208	0.5148	0.3998	0.3006	0.2088	0.1491	0.1609	0.2533	0.4178	0.6084	0.7463	(86)
MIT	20.9795	20.9940	20.9988	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9999	20.9961	20.9757	(87)
Th 2	20.5526	20.5547	20.5568	20.5675	20.5696	20.5802	20.5802	20.5824	20.5760	20.5696	20.5653	20.5611	(88)
util rest of house													
	0.7062	0.6042	0.4992	0.3855	0.2867	0.1951	0.1349	0.1463	0.2377	0.4005	0.5899	0.7294	(89)
MIT 2	20.5313	20.5486	20.5557	20.5674	20.5696	20.5802	20.5802	20.5824	20.5760	20.5695	20.5615	20.5356	(90)
Living area fraction										fLA = Living area / (4) =		0.5577	(91)
MIT	20.7812	20.7970	20.8028	20.8086	20.8096	20.8143	20.8143	20.8153	20.8125	20.8095	20.8039	20.7811	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7812	20.7970	20.8028	20.8086	20.8096	20.8143	20.8143	20.8153	20.8125	20.8095	20.8039	20.7811	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7151	0.6132	0.5079	0.3934	0.2944	0.2028	0.1428	0.1545	0.2464	0.4101	0.6001	0.7379	(94)
Useful gains	388.5487	377.2072	338.9911	275.4626	209.6597	139.3436	94.4978	98.4804	152.1033	234.9415	317.4656	381.9023	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	394.9458	379.0622	339.3534	275.4919	209.6614	139.3436	94.4978	98.4804	152.1035	234.9759	318.6483	389.4786	(97)
Space heating kWh													
	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(98a)
Space heating requirement - total per year (kWh/year)												12.8118	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												12.8118	
Space heating per m2											(98c) / (4) =	0.2489	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9614	8.0942	8.9614	8.6723	8.9614	8.6723	8.9614	8.9614	8.6723	8.9614	8.6723	8.9614	(231)
Lighting	15.5353	12.4630	11.2216	8.2214	6.3505	5.1884	5.7931	7.5301	9.7808	12.8330	14.4948	15.9671	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.3128	-19.6230	-32.0667	-40.6524	-47.9480	-46.2189	-45.4896	-40.9865	-33.3753	-24.2196	-14.2561	-10.3736	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4545	-5.6926	-12.5456	-20.8344	-29.1368	-29.9406	-29.5123	-23.8619	-16.2788	-8.5783	-3.3998	-1.8860	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	12.8118	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2212.9335	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	105.5134	(230a)
Total electricity for the above, kWh/year	105.5134	(231)
Electricity for lighting (calculated in Appendix L)	125.3792	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-551.6441	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1904.9938	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	12.8118	16.4900	2.1127	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	16.4900	364.9127	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	105.5134	16.4900	17.3992	(249)
Energy for lighting	125.3792	16.4900	20.6750	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.5224	16.4900	-60.6044	
PV Unit electricity exported	-184.1216	5.5900	-10.2924	
Total			-70.8968	(252)
Total energy cost			334.2027	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2470	(257)
SAP value		79.7857	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	12.8118	0.1616	2.0705	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2212.9335	0.1413	312.5953	(264)
Space and water heating			314.6658	(265)
Pumps, fans and electric keep-hot	105.5134	0.1387	14.6360	(267)
Energy for lighting	125.3792	0.1443	18.0961	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.5224	0.1322	-48.5906	
PV Unit electricity exported	-184.1216	0.1235	-22.7330	
Total			-71.3237	(269)
Total CO2, kg/year			276.0743	(272)
CO2 emissions per m2			5.3600	(273)
EI value			96.1656	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		51.4800 (1b)	x	2.4000 (2b)	=	123.5520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.4800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	123.5520	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	15.7900	7.8800	7.9100	0.1400	1.1074	14.0000	110.7400	(29a)
Total net area of external elements Aum(A, m2)			15.7900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.8450			(33)
Party Wall 1			47.5200	0.0000	0.0000	20.0000	950.4000	(32)
Wall to corridor			15.7900	0.0000	0.0000	20.0000	315.8000	(32)
Party Floor 1			51.4800			80.0000	4118.4000	(32d)
Party Ceiling 1			51.4800			80.0000	4118.4000	(32b)
Internal Wall 1			80.1900			9.0000	721.7100	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 10335.4500 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 200.7663 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.8500	0.0700	0.4095
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.4500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.3670 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 12.2120 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.8698	11.8698	11.6328	10.9218	10.8033	10.3294	10.0924	10.0924	10.5664	11.1588	11.3958	11.2773	(38)
Heat transfer coeff	24.0818	24.0818	23.8448	23.1339	23.0154	22.5414	22.3044	22.3044	22.7784	23.3709	23.6079	23.4894	(39)

Average = Sum(39)m / 12 = 23.2129

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4678	0.4678	0.4632	0.4494	0.4471	0.4379	0.4333	0.4333	0.4425	0.4540	0.4586	0.4563	(40)
HLP (average)												0.4509	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7337 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.2716	72.1705	70.5659	67.4959	65.2303	62.7037	61.2676	62.8600	64.6056	67.3184	70.4543	72.9909	(42a)
Hot water usage for baths	23.0390	22.6968	22.2150	21.3266	20.6614	19.9237	19.5253	20.0037	20.5247	21.3140	22.2207	22.9611	(42b)
Hot water usage for other uses	32.3851	31.2075	30.0298	28.8522	27.6746	26.4969	26.4969	27.6746	28.8522	30.0298	31.2075	32.3851	(42c)

Average daily hot water use (litres/day) 118.3558 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.6957	126.0748	122.8108	117.6747	113.5662	109.1243	107.2898	110.5383	113.9825	118.6622	123.8825	128.3371	(44)
Energy conte	203.8226	179.5288	188.7556	161.0907	152.8819	134.1811	129.7577	136.8695	140.5518	161.0235	176.4934	200.9449	(45)
Energy content (annual)										Total = Sum(45)m =		1965.9015	
Distribution loss (46)m = 0.15 x (45)m	30.5734	26.9293	28.3133	24.1636	22.9323	20.1272	19.4636	20.5304	21.0828	24.1535	26.4740	30.1417	(46)

Water storage loss:

Store volume 143.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)

Temperature factor from Table 2b 0.6000 (49)

Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
										Total per year (kWh/year) = Sum(64)m =		2212.9335	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	84.5557	74.8537	79.5459	69.8059	67.6179	60.8584	59.9291	62.2937	62.9767	70.3250	74.9273	83.5988	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	17.7487	15.7643	12.8204	9.7058	7.2552	6.1252	6.6185	8.6029	11.5468	14.6613	17.1120	18.2420	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	225.4877	227.8276	221.9312	209.3786	193.5331	178.6406	168.6914	166.3516	172.2479	184.8006	200.6461	215.5386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	(71)
Water heating gains (Table 5)													
	113.6501	111.3894	106.9165	96.9526	90.8842	84.5256	80.5498	83.7281	87.4676	94.5228	104.0656	112.3640	(72)
Total internal gains													
	438.6972	436.7919	423.4788	397.8477	373.4832	351.1020	337.6704	340.4934	353.0731	375.7954	403.6344	427.9553	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(77)

Solar gains	95.2051	173.0844	247.4999	322.5774	357.6553	345.0938	336.8383	300.1802	265.5901	190.1488	117.1921	83.3220	(83)
Total gains	533.9023	609.8763	670.9786	720.4250	731.1385	696.1958	674.5087	640.6735	618.6632	565.9442	520.8265	511.2773	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	119.2167	119.2167	120.4016	124.1019	124.7408	127.3637	128.7170	128.7170	126.0386	122.8434	121.6103	122.2237	
alpha	8.9478	8.9478	9.0268	9.2735	9.3161	9.4909	9.5811	9.5811	9.4026	9.1896	9.1074	9.1482	
util living area													
	0.7526	0.6539	0.5462	0.4206	0.3242	0.2525	0.2017	0.2158	0.3019	0.4664	0.6480	0.7727	(86)
MIT	20.9712	20.9903	20.9979	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9996	20.9929	20.9672	(87)
Th 2	20.5504	20.5504	20.5547	20.5675	20.5696	20.5781	20.5824	20.5824	20.5738	20.5632	20.5589	20.5611	(88)
util rest of house													
	0.7357	0.6373	0.5306	0.4067	0.3107	0.2389	0.1879	0.2013	0.2862	0.4484	0.6291	0.7564	(89)
MIT 2	20.5201	20.5405	20.5526	20.5673	20.5696	20.5781	20.5824	20.5824	20.5738	20.5629	20.5519	20.5263	(90)
Living area fraction										fLA = Living area / (4) =		0.5577	(91)
MIT	20.7716	20.7914	20.8010	20.8085	20.8096	20.8134	20.8153	20.8153	20.8115	20.8064	20.7978	20.7722	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7716	20.7914	20.8010	20.8085	20.8096	20.8134	20.8153	20.8153	20.8115	20.8064	20.7978	20.7722	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7441	0.6462	0.5392	0.4144	0.3182	0.2465	0.1956	0.2094	0.2950	0.4585	0.6394	0.7643	(94)
Useful gains	397.2723	394.1170	361.8210	298.5746	232.6729	171.6165	131.9370	134.1674	182.4879	259.4584	332.9973	390.7730	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	406.3003	397.1421	362.4645	298.6242	232.6766	171.6167	131.9370	134.1674	182.4893	259.5673	335.1804	401.0157	(97)
Space heating kWh													
	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205	(98a)
Space heating requirement - total per year (kWh/year)												18.5404	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												18.5404	
Space heating per m2										(98c) / (4) =		0.3601	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9614	8.0942	8.9614	8.6723	8.9614	8.6723	8.9614	8.9614	8.6723	8.9614	8.6723	8.9614	(231)

Lighting	15.5353	12.4630	11.2216	8.2214	6.3505	5.1884	5.7931	7.5301	9.7808	12.8330	14.4948	15.9671 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-11.1496	-18.8721	-32.0603	-42.3899	-49.6609	-46.9012	-46.5595	-40.9992	-33.1527	-23.1943	-13.2464	-9.5840 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.0858	-5.3278	-12.5367	-22.4603	-31.0947	-30.7742	-30.8282	-23.8754	-16.0865	-7.9699	-3.0116	-1.6564 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	18.5404 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2212.9335 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	105.5134 (230a)
Total electricity for the above, kWh/year	105.5134 (231)
Electricity for lighting (calculated in Appendix L)	125.3792 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-555.4776 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1906.8888 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	18.5404	25.1600	4.6648	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	25.1600	556.7741	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	105.5134	25.1600	26.5472	(249)
Energy for lighting	125.3792	25.1600	31.5454	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.7700	25.1600	-92.5309	
PV Unit electricity exported	-187.7076	5.8100	-10.9058	
Total			-103.4367	(252)
Total energy cost			516.0946	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	18.5404	0.1612	2.9893	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2212.9335	0.1413	312.5953	(264)
Space and water heating			315.5847	(265)
Pumps, fans and electric keep-hot	105.5134	0.1387	14.6360	(267)
Energy for lighting	125.3792	0.1443	18.0961	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.7700	0.1319	-48.5087	
PV Unit electricity exported	-187.7076	0.1230	-23.0860	
Total			-71.5947	(269)
Total CO2, kg/year			276.7220	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	18.5404	1.5966	29.6024	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	1.5223	3368.8373	(278)
Space and water heating			3398.4396	(279)
Pumps, fans and electric keep-hot	105.5134	1.5128	159.6207	(281)
Energy for lighting	125.3792	1.5338	192.3107	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.7700	1.4873	-546.9961	
PV Unit electricity exported	-187.7076	0.4514	-84.7250	
Total			-631.7212	(283)
Total Primary energy kWh/year			3118.6499	(286)

SAP 10 EPC IMPROVEMENTS

Unit 164 L05_Copy

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 80
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£620	£620	£0
Space heating	£31	£31	£0
Water heating	£557	£557	£0
Lighting	£32	£32	£0
Generated (PV)	-£103	-£103	£0
Total cost of fuels	£517	£517	£0
Total cost of uses	£517	£517	£0
Delivered energy	37 kWh/m²	37 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	61 kWh/m²	61 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.4800 (1b)	x	2.4000 (2b)	=	123.5520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.4800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	123.5520	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	15.7900	7.8800	7.9100	0.1400	1.1074	14.0000	110.7400	(29a)
Total net area of external elements Aum(A, m2)			15.7900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	10.8450			(33)
Party Wall 1			47.5200	0.0000	0.0000	20.0000	950.4000	(32)
Wall to corridor			15.7900	0.0000	0.0000	20.0000	315.8000	(32)
Party Floor 1			51.4800			80.0000	4118.4000	(32d)
Party Ceiling 1			51.4800			80.0000	4118.4000	(32b)
Internal Wall 1			80.1900			9.0000	721.7100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10335.4500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		200.7663 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.8500	0.0700	0.4095
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.4500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.3670 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	12.2120 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.7513	11.6328	11.5143	10.9218	10.8033	10.2109	10.2109	10.0924	10.4479	10.8033	11.0403	11.2773	(38)
Heat transfer coeff	23.9633	23.8448	23.7264	23.1339	23.0154	22.4229	22.4229	22.3044	22.6599	23.0154	23.2524	23.4894	(39)
Average = Sum(39)m / 12 =												23.1043	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4655	0.4632	0.4609	0.4494	0.4471	0.4356	0.4356	0.4333	0.4402	0.4471	0.4517	0.4563	(40)
HLP (average)												0.4488	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7337	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.2716	72.1705	70.5659	67.4959	65.2303	62.7037	61.2676	62.8600	64.6056	67.3184	70.4543	72.9909	(42a)

Hot water usage for baths

23.0390	22.6968	22.2150	21.3266	20.6614	19.9237	19.5253	20.0037	20.5247	21.3140	22.2207	22.9611	(42b)

Hot water usage for other uses

32.3851	31.2075	30.0298	28.8522	27.6746	26.4969	26.4969	27.6746	28.8522	30.0298	31.2075	32.3851	(42c)

Average daily hot water use (litres/day)	118.3558	(43)

Daily hot water use

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
128.6957	126.0748	122.8108	117.6747	113.5662	109.1243	107.2898	110.5383	113.9825	118.6622	123.8825	128.3371	(44)
Energy conte 203.8226	179.5288	188.7556	161.0907	152.8819	134.1811	129.7577	136.8695	140.5518	161.0235	176.4934	200.9449	(45)

Energy content (annual)	Total = Sum(45)m =	1965.9015

Distribution loss (46)m = 0.15 x (45)m

30.5734	26.9293	28.3133	24.1636	22.9323	20.1272	19.4636	20.5304	21.0828	24.1535	26.4740	30.1417	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)

Total per year (kWh/year) = Sum(64)m =	2212.9335	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000	(64a)

Heat gains from water heating, kWh/month

84.5557	74.8537	79.5459	69.8059	67.6179	60.8584	59.9291	62.2937	62.9767	70.3250	74.9273	83.5988	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.7487	15.7643	12.8204	9.7058	7.2552	6.1252	6.6185	8.6029	11.5468	14.6613	17.1120	18.2420	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	225.4877	227.8276	221.9312	209.3786	193.5331	178.6406	168.6914	166.3516	172.2479	184.8006	200.6461	215.5386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	(71)
Water heating gains (Table 5)	113.6501	111.3894	106.9165	96.9526	90.8842	84.5256	80.5498	83.7281	87.4676	94.5228	104.0656	112.3640	(72)
Total internal gains	438.6972	436.7919	423.4788	397.8477	373.4832	351.1020	337.6704	340.4934	353.0731	375.7954	403.6344	427.9553	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(77)

Solar gains	104.6841	178.3157	243.9793	302.3022	338.6036	336.1550	324.0893	297.0068	264.1780	197.0768	125.3874	89.5877 (83)
Total gains	543.3813	615.1076	667.4580	700.1498	712.0869	687.2570	661.7597	637.5001	617.2510	572.8722	529.0217	517.5431 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	119.8063	120.4016	121.0029	124.1019	124.7408	128.0368	128.0368	128.7170	126.6977	124.7408	123.4694	122.2237	
alpha	8.9871	9.0268	9.0669	9.2735	9.3161	9.5358	9.5358	9.5811	9.4465	9.3161	9.2313	9.1482	
util living area	0.7234	0.6208	0.5148	0.3998	0.3006	0.2088	0.1491	0.1609	0.2533	0.4178	0.6084	0.7463	(86)
MIT	20.9795	20.9940	20.9988	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9999	20.9961	20.9757	(87)
Th 2	20.5526	20.5547	20.5568	20.5675	20.5696	20.5802	20.5802	20.5824	20.5760	20.5696	20.5653	20.5611	(88)
util rest of house	0.7062	0.6042	0.4992	0.3855	0.2867	0.1951	0.1349	0.1463	0.2377	0.4005	0.5899	0.7294	(89)
MIT 2	20.5313	20.5486	20.5557	20.5674	20.5696	20.5802	20.5802	20.5824	20.5760	20.5695	20.5615	20.5356	(90)
Living area fraction									fLA = Living area / (4) =			0.5577	(91)
MIT	20.7812	20.7970	20.8028	20.8086	20.8096	20.8143	20.8143	20.8153	20.8125	20.8095	20.8039	20.7811	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7812	20.7970	20.8028	20.8086	20.8096	20.8143	20.8143	20.8153	20.8125	20.8095	20.8039	20.7811	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7151	0.6132	0.5079	0.3934	0.2944	0.2028	0.1428	0.1545	0.2464	0.4101	0.6001	0.7379	(94)
Useful gains	388.5487	377.2072	338.9911	275.4626	209.6597	139.3436	94.4978	98.4804	152.1033	234.9415	317.4656	381.9023	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	394.9458	379.0622	339.3534	275.4919	209.6614	139.3436	94.4978	98.4804	152.1035	234.9759	318.6483	389.4786	(97)
Space heating kWh	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(98a)
Space heating requirement - total per year (kWh/year)												12.8118	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												12.8118	
Space heating per m2											(98c) / (4) =	0.2489	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9614	8.0942	8.9614	8.6723	8.9614	8.6723	8.9614	8.9614	8.6723	8.9614	8.6723	8.9614	(231)
Lighting	15.5353	12.4630	11.2216	8.2214	6.3505	5.1884	5.7931	7.5301	9.7808	12.8330	14.4948	15.9671	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.3128	-19.6230	-32.0667	-40.6524	-47.9480	-46.2189	-45.4896	-40.9865	-33.3753	-24.2196	-14.2561	-10.3736	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4545	-5.6926	-12.5456	-20.8344	-29.1368	-29.9406	-29.5123	-23.8619	-16.2788	-8.5783	-3.3998	-1.8860	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												12.8118	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2212.9335	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	105.5134	(230a)
Total electricity for the above, kWh/year	105.5134	(231)
Electricity for lighting (calculated in Appendix L)	125.3792	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-551.6441	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1904.9938	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	12.8118	16.4900	2.1127	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	16.4900	364.9127	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	105.5134	16.4900	17.3992	(249)
Energy for lighting	125.3792	16.4900	20.6750	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.5224	16.4900	-60.6044	
PV Unit electricity exported	-184.1216	5.5900	-10.2924	
Total			-70.8968	(252)
Total energy cost			334.2027	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2470	(257)
SAP value	79.7857	
SAP rating (Section 12)	80	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	12.8118	0.1616	2.0705	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2212.9335	0.1413	312.5953	(264)
Space and water heating			314.6658	(265)
Pumps, fans and electric keep-hot	105.5134	0.1387	14.6360	(267)
Energy for lighting	125.3792	0.1443	18.0961	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.5224	0.1322	-48.5906	
PV Unit electricity exported	-184.1216	0.1235	-22.7330	
Total			-71.3237	(269)
Total CO2, kg/year			276.0743	(272)
CO2 emissions per m2			5.3600	(273)
EI value			96.1656	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.4800	(1b)	x 2.4000	(2b) =	123.5520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 51.4800						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		123.5520	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 = 0.0000	(6a)
Number of open flues	0 * 20 = 0.0000	(6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	15.7900	7.8800	7.9100	0.1400	1.1074	14.0000	110.7400	(29a)
Total net area of external elements Aum(A, m2)			15.7900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	10.8450			(33)
Party Wall 1			47.5200	0.0000	0.0000	20.0000	950.4000	(32)
Wall to corridor			15.7900	0.0000	0.0000	20.0000	315.8000	(32)
Party Floor 1			51.4800			80.0000	4118.4000	(32d)
Party Ceiling 1			51.4800			80.0000	4118.4000	(32b)
Internal Wall 1			80.1900			9.0000	721.7100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10335.4500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		200.7663 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.8500	0.0700	0.4095
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.4500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.3670 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	12.2120 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.8698	11.8698	11.6328	10.9218	10.8033	10.3294	10.0924	10.0924	10.5664	11.1588	11.3958	11.2773	(38)
Heat transfer coeff	24.0818	24.0818	23.8448	23.1339	23.0154	22.5414	22.3044	22.3044	22.7784	23.3709	23.6079	23.4894	(39)
Average = Sum(39)m / 12 =												23.2129	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4678	0.4678	0.4632	0.4494	0.4471	0.4379	0.4333	0.4333	0.4425	0.4540	0.4586	0.4563	(40)
HLP (average)												0.4509	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.7337 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.2716	72.1705	70.5659	67.4959	65.2303	62.7037	61.2676	62.8600	64.6056	67.3184	70.4543	72.9909	(42a)

Hot water usage for baths

23.0390	22.6968	22.2150	21.3266	20.6614	19.9237	19.5253	20.0037	20.5247	21.3140	22.2207	22.9611	(42b)

Hot water usage for other uses

32.3851	31.2075	30.0298	28.8522	27.6746	26.4969	26.4969	27.6746	28.8522	30.0298	31.2075	32.3851	(42c)

Average daily hot water use (litres/day)		118.3558 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.6957	126.0748	122.8108	117.6747	113.5662	109.1243	107.2898	110.5383	113.9825	118.6622	123.8825	128.3371	(44)
Energy conte	203.8226	179.5288	188.7556	161.0907	152.8819	134.1811	129.7577	136.8695	140.5518	161.0235	176.4934	200.9449	(45)
Energy content (annual)										Total = Sum(45)m =		1965.9015	

Distribution loss (46)m = 0.15 x (45)m

30.5734	26.9293	28.3133	24.1636	22.9323	20.1272	19.4636	20.5304	21.0828	24.1535	26.4740	30.1417	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
										Total per year (kWh/year) = Sum(64)m =		2212.9335	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	84.5557	74.8537	79.5459	69.8059	67.6179	60.8584	59.9291	62.2937	62.9767	70.3250	74.9273	83.5988	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.7487	15.7643	12.8204	9.7058	7.2552	6.1252	6.6185	8.6029	11.5468	14.6613	17.1120	18.2420	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	225.4877	227.8276	221.9312	209.3786	193.5331	178.6406	168.6914	166.3516	172.2479	184.8006	200.6461	215.5386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	(71)
Water heating gains (Table 5)	113.6501	111.3894	106.9165	96.9526	90.8842	84.5256	80.5498	83.7281	87.4676	94.5228	104.0656	112.3640	(72)
Total internal gains	438.6972	436.7919	423.4788	397.8477	373.4832	351.1020	337.6704	340.4934	353.0731	375.7954	403.6344	427.9553	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(77)

Solar gains	95.2051	173.0844	247.4999	322.5774	357.6553	345.0938	336.8383	300.1802	265.5901	190.1488	117.1921	83.3220	(83)
Total gains	533.9023	609.8763	670.9786	720.4250	731.1385	696.1958	674.5087	640.6735	618.6632	565.9442	520.8265	511.2773	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	119.2167	119.2167	120.4016	124.1019	124.7408	127.3637	128.7170	128.7170	126.0386	122.8434	121.6103	122.2237	
alpha	8.9478	8.9478	9.0268	9.2735	9.3161	9.4909	9.5811	9.5811	9.4026	9.1896	9.1074	9.1482	
util living area	0.7526	0.6539	0.5462	0.4206	0.3242	0.2525	0.2017	0.2158	0.3019	0.4664	0.6480	0.7727	(86)
MIT	20.9712	20.9903	20.9979	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9996	20.9929	20.9672	(87)
Th 2	20.5504	20.5504	20.5547	20.5675	20.5696	20.5781	20.5824	20.5824	20.5738	20.5632	20.5589	20.5611	(88)
util rest of house	0.7357	0.6373	0.5306	0.4067	0.3107	0.2389	0.1879	0.2013	0.2862	0.4484	0.6291	0.7564	(89)
MIT 2	20.5201	20.5405	20.5526	20.5673	20.5696	20.5781	20.5824	20.5824	20.5738	20.5629	20.5519	20.5263	(90)
Living area fraction										fLA = Living area / (4) =		0.5577	(91)
MIT	20.7716	20.7914	20.8010	20.8085	20.8096	20.8134	20.8153	20.8153	20.8115	20.8064	20.7978	20.7722	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7716	20.7914	20.8010	20.8085	20.8096	20.8134	20.8153	20.8153	20.8115	20.8064	20.7978	20.7722	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7441	0.6462	0.5392	0.4144	0.3182	0.2465	0.1956	0.2094	0.2950	0.4585	0.6394	0.7643	(94)
Useful gains	397.2723	394.1170	361.8210	298.5746	232.6729	171.6165	131.9370	134.1674	182.4879	259.4584	332.9973	390.7730	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	406.3003	397.1421	362.4645	298.6242	232.6766	171.6167	131.9370	134.1674	182.4893	259.5673	335.1804	401.0157	(97)
Space heating kWh	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205	(98a)
Space heating requirement - total per year (kWh/year)												18.5404	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												18.5404	
Space heating per m2											(98c) / (4) =	0.3601	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													

	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	8.9614	8.0942	8.9614	8.6723	8.9614	8.6723	8.9614	8.9614	8.6723	8.9614	8.6723	8.9614 (231)
Lighting	15.5353	12.4630	11.2216	8.2214	6.3505	5.1884	5.7931	7.5301	9.7808	12.8330	14.4948	15.9671 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-11.1496	-18.8721	-32.0603	-42.3899	-49.6609	-46.9012	-46.5595	-40.9992	-33.1527	-23.1943	-13.2464	-9.5840 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.0858	-5.3278	-12.5367	-22.4603	-31.0947	-30.7742	-30.8282	-23.8754	-16.0865	-7.9699	-3.0116	-1.6564 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	18.5404 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2212.9335 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	105.5134 (230a)
Total electricity for the above, kWh/year	105.5134 (231)
Electricity for lighting (calculated in Appendix L)	125.3792 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-555.4776 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1906.8888 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	18.5404	25.1600	4.6648	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	25.1600	556.7741	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	105.5134	25.1600	26.5472	(249)
Energy for lighting	125.3792	25.1600	31.5454	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.7700	25.1600	-92.5309	
PV Unit electricity exported	-187.7076	5.8100	-10.9058	
Total			-103.4367	(252)
Total energy cost			516.0946	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	18.5404	0.1612	2.9893	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2212.9335	0.1413	312.5953	(264)
Space and water heating			315.5847	(265)
Pumps, fans and electric keep-hot	105.5134	0.1387	14.6360	(267)
Energy for lighting	125.3792	0.1443	18.0961	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.7700	0.1319	-48.5087	
PV Unit electricity exported	-187.7076	0.1230	-23.0860	
Total			-71.5947	(269)
Total CO2, kg/year			276.7220	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	18.5404	1.5966	29.6024	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	1.5223	3368.8373	(278)
Space and water heating			3398.4396	(279)

Pumps, fans and electric keep-hot	105.5134	1.5128	159.6207 (281)
Energy for lighting	125.3792	1.5338	192.3107 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-367.7700	1.4873	-546.9961
PV Unit electricity exported	-187.7076	0.4514	-84.7250
Total			-631.7212 (283)
Total Primary energy kWh/year			3118.6499 (286)

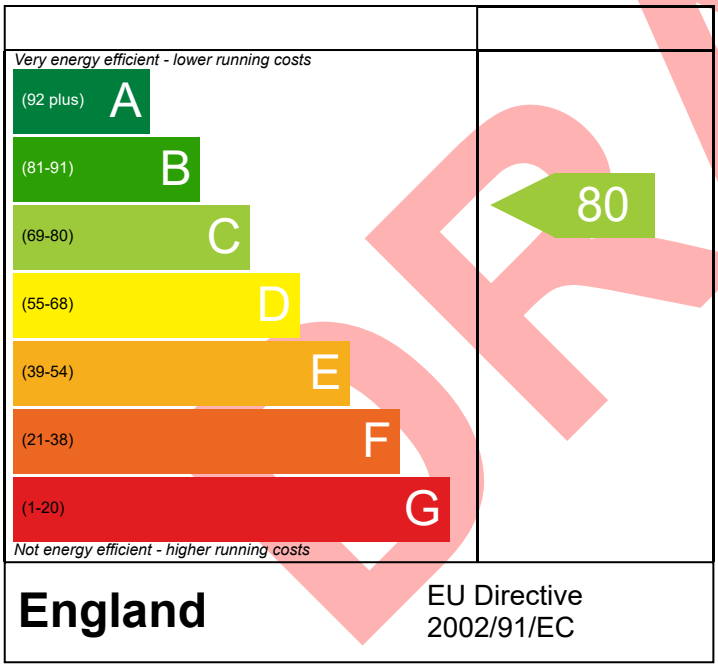
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	51.48 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

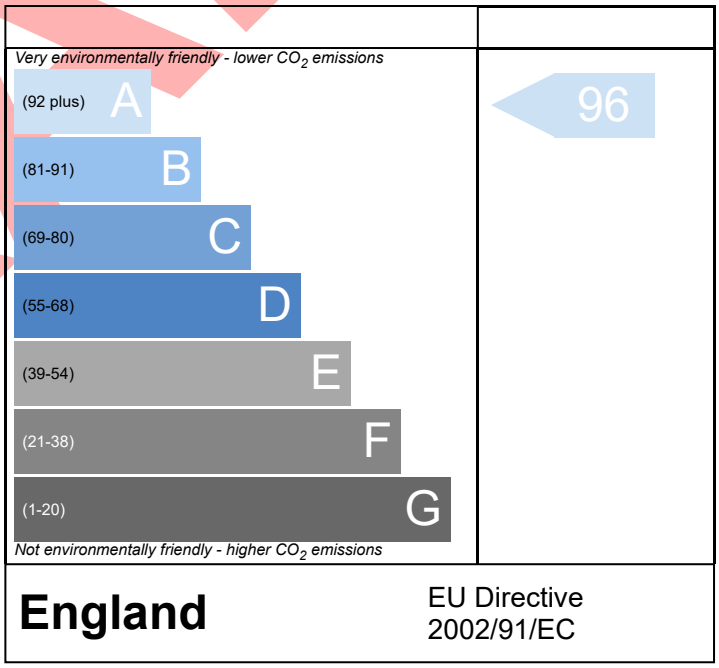
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:27

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	66 m^2
Site Reference	Unit 165 L05_Copy	Plot Reference	Unit 165 L05_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*12.09 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	5.9 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*65.26 kWh_{PE}/m^2*	
Dwelling primary energy	65.22 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*25.4 kWh/m^2*	
Dwelling fabric energy efficiency	26.2 kWh/m^2	FAIL

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	21.88	0.14 **(!)**
Party wall: Party Wall (1)	30.24	0 **(!)**
Party wall: Party Wall (2)	14.18	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	7.88	North East	0.83	1.3
N, Opening Type 1	3.59	North	0.83	1.3
NW, Opening Type 1	7.88	North West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.85 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 165 L05_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 165 L05_Copy	**Prop Type Ref**	Unit 164 L05
Property			

SAP Rating	77 C	**DER**	5.90	**TER**	12.09
Environmental	95 A	**% DER < TER**			51.20
CO_2 Emissions (t/year)	0.39	**DFEE**	26.20	**TFEE**	25.40
Compliance Check	See BREL	**% DFEE < TFEE**			-3.16
% DPER < TPER	0.06	**DPER**	65.22	**TPER**	65.26

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.6000 (1b)	x	2.4000 (2b)	=	157.4400	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.6000					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	157.4400	(5)

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2. Ventilation rate

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	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.3500	1.2357	23.9116			(27)
External Wall 1	41.2300	19.3500	21.8800	0.1400	3.0632	14.0000	306.3200	(29a)
Total net area of external elements Aum(A, m2)			41.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.9748			(33)
Party Wall 1			30.2400	0.0000	0.0000	20.0000	604.8000	(32)
Wall to corridor			14.1800	0.0000	0.0000	20.0000	283.6000	(32)
Party Floor 1			65.6000			80.0000	5248.0000	(32d)
Party Ceiling 1			65.6000			80.0000	5248.0000	(32b)
Internal Wall 1			114.4800			9.0000	1030.3200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12721.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		193.9183 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240

E4 Jamb	23.2000	0.0500	1.1600	
E7 Party floor between dwellings (in blocks of flats)	15.2700	0.0700	1.0689	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.4500	0.0000	0.0000	
E16 Corner (normal)	5.4000	0.0900	0.4860	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.4629 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 30.4377 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.7197	15.5541	15.3885	14.5604	14.3948	13.5668	13.5668	13.4012	13.8980	14.3948	14.7261	15.0573	(38)
Heat transfer coeff	46.1574	45.9918	45.8262	44.9981	44.8325	44.0045	44.0045	43.8389	44.3357	44.8325	45.1637	45.4950	(39)
Average = Sum(39)m / 12 =												44.9567	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7036	0.7011	0.6986	0.6859	0.6834	0.6708	0.6708	0.6683	0.6758	0.6834	0.6885	0.6935	(40)
HLP (average)												0.6853	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1348 (42)
Hot water usage for mixer showers

82.5173	81.2772	79.4702	76.0128	73.4613	70.6159	68.9985	70.7919	72.7577	75.8128	79.3445	82.2011	(42a)

Hot water usage for baths

25.9306	25.5455	25.0032	24.0033	23.2545	22.4243	21.9759	22.5144	23.1007	23.9891	25.0096	25.8429	(42b)

Hot water usage for other uses

36.4921	35.1651	33.8381	32.5112	31.1842	29.8572	29.8572	31.1842	32.5112	33.8381	35.1651	36.4921	(42c)

Average daily hot water use (litres/day) 133.2946 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.9400	141.9879	138.3115	132.5272	127.9000	122.8974	120.8316	124.4905	128.3696	133.6401	139.5193	144.5362	(44)
Energy conte	229.5496	202.1888	212.5797	181.4231	172.1780	151.1167	146.1353	154.1452	158.2926	181.3483	198.7708	226.3088	(45)
Energy content (annual)										Total = Sum(45)m =		2214.0368	

Distribution loss (46)m = 0.15 x (45)m

34.4324	30.3283	31.8870	27.2135	25.8267	22.6675	21.9203	23.1218	23.7439	27.2023	29.8156	33.9463	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)

Total per year (kWh/year) = Sum(64)m = 2461.0688 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

93.1099	82.3881	87.4674	76.5664	74.0338	66.4895	65.3746	68.0379	68.8755	77.0830	82.3345	92.0323	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.5047	19.1002	15.5334	11.7598	8.7906	7.4214	8.0190	10.4234	13.9903	17.7639	20.7331	22.1023	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	278.8333	281.7267	274.4354	258.9131	239.3189	220.9031	208.6002	205.7068	212.9981	228.5205	248.1147	266.5304	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(70)
Losses e.g. evaporation (negative values) (Table 5)	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	(71)
Water heating gains (Table 5)	125.1477	122.6013	117.5637	106.3422	99.5078	92.3465	87.8691	91.4488	95.6604	103.6061	114.3535	123.6993	(72)
Total internal gains	518.1243	516.0669	500.1711	469.6536	440.2559	413.3096	397.1270	400.2177	415.2875	442.5292	475.8399	504.9707	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5900	10.6334	0.6300	0.8270	0.7700	13.7831	(74)
Northeast	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(75)
Northwest	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(81)

Solar gains 77.9864	157.0279	280.2162	458.5828	616.6334	657.8250	615.1898	490.0648	340.7231	191.0654	97.7876	63.9219	(83)
Total gains 596.1107	673.0949	780.3873	928.2365	1056.8893	1071.1345	1012.3168	890.2825	756.0106	633.5945	573.6275	568.8927	(84)

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7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
tau	76.5559	76.8316	77.1093	78.5282	78.8183	80.3014	80.3014	80.6047	79.7015	78.8183	78.2402	77.6706	
alpha	6.1037	6.1221	6.1406	6.2352	6.2546	6.3534	6.3534	6.3736	6.3134	6.2546	6.2160	6.1780	
util living area	0.9437	0.8971	0.7825	0.5777	0.3938	0.2629	0.1913	0.2265	0.4038	0.7039	0.8971	0.9531	(86)
MIT	20.5409	20.6986	20.8811	20.9817	20.9983	20.9999	21.0000	21.0000	20.9987	20.9551	20.7496	20.5092	(87)
Th 2	20.3376	20.3399	20.3421	20.3533	20.3555	20.3667	20.3667	20.3689	20.3622	20.3555	20.3510	20.3466	(88)
util rest of house	0.9339	0.8815	0.7577	0.5488	0.3667	0.2369	0.1637	0.1954	0.3668	0.6677	0.8790	0.9447	(89)
MIT 2	19.8185	20.0094	20.2201	20.3364	20.3542	20.3666	20.3667	20.3689	20.3613	20.3148	20.0834	19.7875	(90)
Living area fraction										fLA = Living area / (4) =		0.4663	(91)
MIT	20.1554	20.3308	20.5284	20.6373	20.6546	20.6619	20.6620	20.6632	20.6585	20.6134	20.3941	20.1241	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1554	20.3308	20.5284	20.6373	20.6546	20.6619	20.6620	20.6632	20.6585	20.6134	20.3941	20.1241	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9309	0.8813	0.7649	0.5616	0.3793	0.2490	0.1766	0.2099	0.3841	0.6825	0.8803	0.9414	(94)
Useful gains	554.9067	593.1911	596.9001	521.2762	400.8703	266.7233	178.7442	186.8865	290.3468	432.4035	504.9500	535.5811	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	731.8424	709.6904	642.8668	528.1577	401.4553	266.7525	178.7466	186.8936	290.7766	448.9253	600.4104	724.4643	(97)
Space heating kWh	131.6402	78.2875	34.1992	4.9547	0.4352	0.0000	0.0000	0.0000	0.0000	12.2922	68.7315	140.5291	(98a)
Space heating requirement - total per year (kWh/year)												471.0696	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	131.6402	78.2875	34.1992	4.9547	0.4352	0.0000	0.0000	0.0000	0.0000	12.2922	68.7315	140.5291	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												471.0696	
Space heating per m2											(98c) / (4) =	7.1809	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	131.6402	78.2875	34.1992	4.9547	0.4352	0.0000	0.0000	0.0000	0.0000	12.2922	68.7315	140.5291	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	131.6402	78.2875	34.1992	4.9547	0.4352	0.0000	0.0000	0.0000	0.0000	12.2922	68.7315	140.5291	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	12.1045	10.9331	12.1045	11.7141	12.1045	11.7141	12.1045	12.1045	11.7141	12.1045	11.7141	12.1045	(231)
Lighting	18.8229	15.1004	13.5963	9.9612	7.6943	6.2863	7.0190	9.1236	11.8506	15.5487	17.5622	19.3460	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.8151	-25.1332	-40.5864	-50.8024	-59.6183	-57.3843	-56.4723	-50.9617	-41.6122	-30.4646	-18.2004	-13.3279	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.9195	-6.9836	-16.0113	-27.2032	-38.1758	-39.2360	-38.6794	-31.3088	-21.3818	-11.1448	-4.1988	-2.2253	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	471.0696	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2461.0688	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	142.5210	(230a)
Total electricity for the above, kWh/year	142.5210	(231)
Electricity for lighting (calculated in Appendix L)	151.9116	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-699.8470	(233)
Wind generation	0.0000	(234)

Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2526.7240	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	471.0696	16.4900	77.6794	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	16.4900	405.8302	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	142.5210	16.4900	23.5017	(249)
Energy for lighting	151.9116	16.4900	25.0502	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.3787	16.4900	-75.9165	
PV Unit electricity exported	-239.4682	5.5900	-13.3863	
Total			-89.3027	(252)
Total energy cost			442.7588	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.4412	(257)
SAP value	76.6387	
SAP rating (Section 12)	77	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	471.0696	0.1591	74.9382	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2461.0688	0.1413	347.7259	(264)
Space and water heating			422.6642	(265)
Pumps, fans and electric keep-hot	142.5210	0.1387	19.7694	(267)
Energy for lighting	151.9116	0.1443	21.9255	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.3787	0.1324	-60.9461	
PV Unit electricity exported	-239.4682	0.1230	-29.4551	
Total			-90.4011	(269)
Total CO2, kg/year			373.9580	(272)
CO2 emissions per m2			5.7000	(273)
EI value			95.4692	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.6000 (1b)	x	2.4000 (2b)	=	157.4400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	157.4400	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.3500	1.2357	23.9116			(27)
External Wall 1	41.2300	19.3500	21.8800	0.1400	3.0632	14.0000	306.3200	(29a)
Total net area of external elements Aum(A, m2)			41.2300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.9748			(33)
Party Wall 1			30.2400	0.0000	0.0000	20.0000	604.8000	(32)
Wall to corridor			14.1800	0.0000	0.0000	20.0000	283.6000	(32)
Party Floor 1			65.6000			80.0000	5248.0000	(32d)
Party Ceiling 1			65.6000			80.0000	5248.0000	(32b)
Internal Wall 1			114.4800			9.0000	1030.3200	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12721.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 193.9183 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	15.2700	0.0700	1.0689
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.4500	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.4629 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 30.4377 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.8853	15.8853	15.5541	14.5604	14.3948	13.7324	13.4012	13.4012	14.0636	14.8917	15.2229	15.0573	(38)
Heat transfer coeff	46.3230	46.3230	45.9918	44.9981	44.8325	44.1701	43.8389	43.8389	44.5013	45.3294	45.6606	45.4950	(39)

Average = Sum(39)m / 12 = 45.1085

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7061	0.7061	0.7011	0.6859	0.6834	0.6733	0.6683	0.6683	0.6784	0.6910	0.6960	0.6935	(40)
HLP (average)												0.6876	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1348 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	82.5173	81.2772	79.4702	76.0128	73.4613	70.6159	68.9985	70.7919	72.7577	75.8128	79.3445	82.2011	(42a)
Hot water usage for baths	25.9306	25.5455	25.0032	24.0033	23.2545	22.4243	21.9759	22.5144	23.1007	23.9891	25.0096	25.8429	(42b)
Hot water usage for other uses	36.4921	35.1651	33.8381	32.5112	31.1842	29.8572	29.8572	31.1842	32.5112	33.8381	35.1651	36.4921	(42c)

Average daily hot water use (litres/day) 133.2946 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.9400	141.9879	138.3115	132.5272	127.9000	122.8974	120.8316	124.4905	128.3696	133.6401	139.5193	144.5362	(44)
Energy conte	229.5496	202.1888	212.5797	181.4231	172.1780	151.1167	146.1353	154.1452	158.2926	181.3483	198.7708	226.3088	(45)

Energy content (annual) Total = Sum(45)m = 2214.0368
Distribution loss (46)m = 0.15 x (45)m

	34.4324	30.3283	31.8870	27.2135	25.8267	22.6675	21.9203	23.1218	23.7439	27.2023	29.8156	33.9463	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)

Total per year (kWh/year) = Sum(64)m = 2461.0688 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

	93.1099	82.3881	87.4674	76.5664	74.0338	66.4895	65.3746	68.0379	68.8755	77.0830	82.3345	92.0323	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	21.5047	19.1002	15.5334	11.7598	8.7906	7.4214	8.0190	10.4234	13.9903	17.7639	20.7331	22.1023	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	278.8333	281.7267	274.4354	258.9131	239.3189	220.9031	208.6002	205.7068	212.9981	228.5205	248.1147	266.5304	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	(71)

Water heating gains (Table 5)

	125.1477	122.6013	117.5637	106.3422	99.5078	92.3465	87.8691	91.4488	95.6604	103.6061	114.3535	123.6993	(72)

Total internal gains

	518.1243	516.0669	500.1711	469.6536	440.2559	413.3096	397.1270	400.2177	415.2875	442.5292	475.8399	504.9707	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5900	9.5462	0.6300	0.8270	0.7700	12.3738	(74)
Northeast	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(75)
Northwest	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(81)

Solar gains	69.4528	148.6778	276.6041	477.3240	638.3689	663.6861	627.6104	484.0300	333.4428	179.5688	89.3871	58.2939	(83)
Total gains	587.5771	664.7447	776.7752	946.9776	1078.6248	1076.9957	1024.7374	884.2477	748.7303	622.0980	565.2270	563.2647	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.2822	76.2822	76.8316	78.5282	78.8183	80.0003	80.6047	80.6047	79.4049	77.9544	77.3889	77.6706	
alpha	6.0855	6.0855	6.1221	6.2352	6.2546	6.3334	6.3736	6.3736	6.2937	6.1970	6.1593	6.1780	
util living area	0.9523	0.9151	0.8170	0.6098	0.4269	0.3197	0.2609	0.3073	0.4846	0.7655	0.9164	0.9604	(86)
MIT	20.4877	20.6359	20.8375	20.9735	20.9971	20.9996	20.9999	20.9998	20.9955	20.9203	20.6918	20.4562	(87)
Th 2	20.3354	20.3354	20.3399	20.3533	20.3555	20.3645	20.3689	20.3689	20.3600	20.3488	20.3443	20.3466	(88)
util rest of house	0.9439	0.9018	0.7950	0.5824	0.4005	0.2937	0.2339	0.2760	0.4477	0.7329	0.9011	0.9533	(89)
MIT 2	19.7510	19.9303	20.1689	20.3280	20.3531	20.3642	20.3689	20.3688	20.3565	20.2729	20.0092	19.7217	(90)
Living area fraction									fLA = Living area / (4) =			0.4663	(91)
MIT	20.0946	20.2593	20.4807	20.6290	20.6534	20.6605	20.6631	20.6630	20.6545	20.5748	20.3275	20.0642	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0946	20.2593	20.4807	20.6290	20.6534	20.6605	20.6631	20.6630	20.6545	20.5748	20.3275	20.0642	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9404	0.9002	0.7998	0.5942	0.4127	0.3059	0.2465	0.2906	0.4648	0.7445	0.9007	0.9498	(94)
Useful gains	552.5820	598.3955	621.2894	562.6696	445.1856	329.4043	252.6245	256.9595	347.9863	463.1695	509.0750	534.9752	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	750.1804	739.2834	684.3902	572.7824	446.2351	329.5308	252.6499	257.0288	349.5347	492.9470	626.8071	744.4884	(97)
Space heating kWh	147.0132	94.6766	46.9470	7.2812	0.7808	0.0000	0.0000	0.0000	0.0000	22.1544	84.7671	155.8778	(98a)
Space heating requirement - total per year (kWh/year)												559.4982	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	147.0132	94.6766	46.9470	7.2812	0.7808	0.0000	0.0000	0.0000	0.0000	22.1544	84.7671	155.8778	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												559.4982	
Space heating per m2											(98c) / (4) =	8.5289	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	147.0132	94.6766	46.9470	7.2812	0.7808	0.0000	0.0000	0.0000	0.0000	22.1544	84.7671	155.8778	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	147.0132	94.6766	46.9470	7.2812	0.7808	0.0000	0.0000	0.0000	0.0000	22.1544	84.7671	155.8778	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
Efficiency of water heater												100.0000	(216)

(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	12.1045	10.9331	12.1045	11.7141	12.1045	11.7141	12.1045	12.1045	11.7141	12.1045	11.7141	12.1045	(231)
Lighting	18.8229	15.1004	13.5963	9.9612	7.6943	6.2863	7.0190	9.1236	11.8506	15.5487	17.5622	19.3460	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.3335	-24.2496	-40.7429	-53.0154	-61.7317	-58.2186	-57.7804	-50.9772	-41.3377	-29.2830	-16.9564	-12.3241	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4576	-6.4518	-15.8354	-29.2573	-40.7194	-40.3248	-40.3981	-31.3264	-21.1298	-10.2536	-3.6695	-1.9361	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	559.4982	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2461.0688	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	142.5210	(230a)
Total electricity for the above, kWh/year	142.5210	(231)
Electricity for lighting (calculated in Appendix L)	151.9116	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-704.7104	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2610.2892	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	559.4982	25.1600	140.7697	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	25.1600	619.2049	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	142.5210	25.1600	35.8583	(249)
Energy for lighting	151.9116	25.1600	38.2210	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.9505	25.1600	-115.9752	
PV Unit electricity exported	-243.7598	5.8100	-14.1624	
Total			-130.1376	(252)
Total energy cost			703.9163	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	559.4982	0.1585	88.6595	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2461.0688	0.1413	347.7259	(264)
Space and water heating			436.3854	(265)
Pumps, fans and electric keep-hot	142.5210	0.1387	19.7694	(267)
Energy for lighting	151.9116	0.1443	21.9255	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.9505	0.1321	-60.8840	
PV Unit electricity exported	-243.7598	0.1225	-29.8531	
Total			-90.7371	(269)
Total CO2, kg/year			387.3433	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	559.4982	1.5865	887.6647	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	1.5225	3746.8812	(278)
Space and water heating			4634.5458	(279)
Pumps, fans and electric keep-hot	142.5210	1.5128	215.6057	(281)
Energy for lighting	151.9116	1.5338	233.0071	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.9505	1.4880	-685.9054	
PV Unit electricity exported	-243.7598	0.4495	-109.5580	
Total			-795.4634	(283)
Total Primary energy kWh/year			4287.6952	(286)

SAP 10 EPC IMPROVEMENTS

Unit 165 L05_Copy

Current energy efficiency rating: C 77
Current environmental impact rating: A 95

N Solar water heating	Not applicable
U Solar photovoltaic panels	Not applicable
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 77
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£834	£834	£0
Space heating	£177	£177	£0
Water heating	£619	£619	£0
Lighting	£38	£38	£0
Generated (PV)	-£130	-£130	£0
Total cost of fuels	£704	£704	£0
Total cost of uses	£704	£704	£0
Delivered energy	40 kWh/m²	40 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	65 kWh/m²	65 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.6000 (1b)	x	2.4000 (2b)	=	157.4400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	157.4400	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.3500	1.2357	23.9116			(27)
External Wall 1	41.2300	19.3500	21.8800	0.1400	3.0632	14.0000	306.3200	(29a)
Total net area of external elements Aum(A, m2)			41.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.9748			(33)
Party Wall 1			30.2400	0.0000	0.0000	20.0000	604.8000	(32)
Wall to corridor			14.1800	0.0000	0.0000	20.0000	283.6000	(32)
Party Floor 1			65.6000			80.0000	5248.0000	(32d)
Party Ceiling 1			65.6000			80.0000	5248.0000	(32b)
Internal Wall 1			114.4800			9.0000	1030.3200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12721.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		193.9183 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	15.2700	0.0700	1.0689
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.4500	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.4629 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	30.4377 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.7197	15.5541	15.3885	14.5604	14.3948	13.5668	13.5668	13.4012	13.8980	14.3948	14.7261	15.0573	(38)
Heat transfer coeff	46.1574	45.9918	45.8262	44.9981	44.8325	44.0045	44.0045	43.8389	44.3357	44.8325	45.1637	45.4950	(39)
Average = Sum(39)m / 12 =												44.9567	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7036	0.7011	0.6986	0.6859	0.6834	0.6708	0.6708	0.6683	0.6758	0.6834	0.6885	0.6935	(40)
HLP (average)												0.6853	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.1348 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
82.5173	81.2772	79.4702	76.0128	73.4613	70.6159	68.9985	70.7919	72.7577	75.8128	79.3445	82.2011	(42a)

Hot water usage for baths

25.9306	25.5455	25.0032	24.0033	23.2545	22.4243	21.9759	22.5144	23.1007	23.9891	25.0096	25.8429	(42b)

Hot water usage for other uses

36.4921	35.1651	33.8381	32.5112	31.1842	29.8572	29.8572	31.1842	32.5112	33.8381	35.1651	36.4921	(42c)

Average daily hot water use (litres/day)		133.2946 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.9400	141.9879	138.3115	132.5272	127.9000	122.8974	120.8316	124.4905	128.3696	133.6401	139.5193	144.5362	(44)
Energy conte	229.5496	202.1888	212.5797	181.4231	172.1780	151.1167	146.1353	154.1452	158.2926	181.3483	198.7708	226.3088	(45)
Energy content (annual)										Total = Sum(45)m =		2214.0368	
Distribution loss (46)m = 0.15 x (45)m	34.4324	30.3283	31.8870	27.2135	25.8267	22.6675	21.9203	23.1218	23.7439	27.2023	29.8156	33.9463	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
									Total per year (kWh/year) = Sum(64)m =		2461.0688	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000 (64a)

Heat gains from water heating, kWh/month

93.1099	82.3881	87.4674	76.5664	74.0338	66.4895	65.3746	68.0379	68.8755	77.0830	82.3345	92.0323	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.5047	19.1002	15.5334	11.7598	8.7906	7.4214	8.0190	10.4234	13.9903	17.7639	20.7331	22.1023	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	278.8333	281.7267	274.4354	258.9131	239.3189	220.9031	208.6002	205.7068	212.9981	228.5205	248.1147	266.5304	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(70)
Losses e.g. evaporation (negative values) (Table 5)	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	(71)
Water heating gains (Table 5)	125.1477	122.6013	117.5637	106.3422	99.5078	92.3465	87.8691	91.4488	95.6604	103.6061	114.3535	123.6993	(72)

Total internal gains

	518.1243	516.0669	500.1711	469.6536	440.2559	413.3096	397.1270	400.2177	415.2875	442.5292	475.8399	504.9707 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5900	10.6334	0.6300	0.8270	0.7700	13.7831	(74)
Northeast	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(75)
Northwest	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(81)

Solar gains	77.9864	157.0279	280.2162	458.5828	616.6334	657.8250	615.1898	490.0648	340.7231	191.0654	97.7876	63.9219	(83)
Total gains	596.1107	673.0949	780.3873	928.2365	1056.8893	1071.1345	1012.3168	890.2825	756.0106	633.5945	573.6275	568.8927	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.5559	76.8316	77.1093	78.5282	78.8183	80.3014	80.3014	80.6047	79.7015	78.8183	78.2402	77.6706	
alpha	6.1037	6.1221	6.1406	6.2352	6.2546	6.3534	6.3534	6.3736	6.3134	6.2546	6.2160	6.1780	
util living area	0.9437	0.8971	0.7825	0.5777	0.3938	0.2629	0.1913	0.2265	0.4038	0.7039	0.8971	0.9531	(86)
MIT	20.5409	20.6986	20.8811	20.9817	20.9983	20.9999	21.0000	21.0000	20.9987	20.9551	20.7496	20.5092	(87)
Th 2	20.3376	20.3399	20.3421	20.3533	20.3555	20.3667	20.3667	20.3689	20.3622	20.3555	20.3510	20.3466	(88)
util rest of house	0.9339	0.8815	0.7577	0.5488	0.3667	0.2369	0.1637	0.1954	0.3668	0.6677	0.8790	0.9447	(89)
MIT 2	19.8185	20.0094	20.2201	20.3364	20.3542	20.3666	20.3667	20.3689	20.3613	20.3148	20.0834	19.7875	(90)
Living area fraction									fLA = Living area / (4) =			0.4663	(91)
MIT	20.1554	20.3308	20.5284	20.6373	20.6546	20.6619	20.6620	20.6632	20.6585	20.6134	20.3941	20.1241	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1554	20.3308	20.5284	20.6373	20.6546	20.6619	20.6620	20.6632	20.6585	20.6134	20.3941	20.1241	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9309	0.8813	0.7649	0.5616	0.3793	0.2490	0.1766	0.2099	0.3841	0.6825	0.8803	0.9414	(94)
Useful gains	554.9067	593.1911	596.9001	521.2762	400.8703	266.7233	178.7442	186.8865	290.3468	432.4035	504.9500	535.5811	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	731.8424	709.6904	642.8668	528.1577	401.4553	266.7525	178.7466	186.8936	290.7766	448.9253	600.4104	724.4643	(97)
Space heating kWh	131.6402	78.2875	34.1992	4.9547	0.4352	0.0000	0.0000	0.0000	0.0000	12.2922	68.7315	140.5291	(98a)
Space heating requirement - total per year (kWh/year)												471.0696	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	131.6402	78.2875	34.1992	4.9547	0.4352	0.0000	0.0000	0.0000	0.0000	12.2922	68.7315	140.5291	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												471.0696	
Space heating per m2											(98c) / (4) =	7.1809	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	131.6402	78.2875	34.1992	4.9547	0.4352	0.0000	0.0000	0.0000	0.0000	12.2922	68.7315	140.5291	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	131.6402	78.2875	34.1992	4.9547	0.4352	0.0000	0.0000	0.0000	0.0000	12.2922	68.7315	140.5291	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	12.1045	10.9331	12.1045	11.7141	12.1045	11.7141	12.1045	12.1045	11.7141	12.1045	11.7141	12.1045	(231)
Lighting	18.8229	15.1004	13.5963	9.9612	7.6943	6.2863	7.0190	9.1236	11.8506	15.5487	17.5622	19.3460	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.8151	-25.1332	-40.5864	-50.8024	-59.6183	-57.3843	-56.4723	-50.9617	-41.6122	-30.4646	-18.2004	-13.3279	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													

(233b)m	-2.9195	-6.9836	-16.0113	-27.2032	-38.1758	-39.2360	-38.6794	-31.3088	-21.3818	-11.1448	-4.1988	-2.2253	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	471.0696	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2461.0688	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	142.5210	(230a)
Total electricity for the above, kWh/year	142.5210	(231)
Electricity for lighting (calculated in Appendix L)	151.9116	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-699.8470	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2526.7240	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	471.0696	16.4900	77.6794	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	16.4900	405.8302	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	142.5210	16.4900	23.5017	(249)
Energy for lighting	151.9116	16.4900	25.0502	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.3787	16.4900	-75.9165	
PV Unit electricity exported	-239.4682	5.5900	-13.3863	
Total			-89.3027	(252)
Total energy cost			442.7588	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.4412	(257)
SAP value		76.6387	
SAP rating (Section 12)		77	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	471.0696	0.1591	74.9382	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2461.0688	0.1413	347.7259	(264)
Space and water heating			422.6642	(265)
Pumps, fans and electric keep-hot	142.5210	0.1387	19.7694	(267)
Energy for lighting	151.9116	0.1443	21.9255	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.3787	0.1324	-60.9461	
PV Unit electricity exported	-239.4682	0.1230	-29.4551	
Total			-90.4011	(269)
Total CO2, kg/year			373.9580	(272)
CO2 emissions per m2			5.7000	(273)
EI value			95.4692	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		65.6000 (1b)	x	2.4000 (2b)	=	157.4400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.6000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	157.4400	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.3500	1.2357	23.9116			(27)
External Wall 1	41.2300	19.3500	21.8800	0.1400	3.0632	14.0000	306.3200	(29a)
Total net area of external elements Aum(A, m2)			41.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.9748			(33)
Party Wall 1			30.2400	0.0000	0.0000	20.0000	604.8000	(32)
Wall to corridor			14.1800	0.0000	0.0000	20.0000	283.6000	(32)
Party Floor 1			65.6000			80.0000	5248.0000	(32d)
Party Ceiling 1			65.6000			80.0000	5248.0000	(32b)
Internal Wall 1			114.4800			9.0000	1030.3200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12721.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		193.9183 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	15.2700	0.0700	1.0689
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.4500	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.4629 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	30.4377 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.8853	15.8853	15.5541	14.5604	14.3948	13.7324	13.4012	13.4012	14.0636	14.8917	15.2229	15.0573	(38)
Heat transfer coeff	46.3230	46.3230	45.9918	44.9981	44.8325	44.1701	43.8389	43.8389	44.5013	45.3294	45.6606	45.4950	(39)
Average = Sum(39)m / 12 =												45.1085	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7061	0.7061	0.7011	0.6859	0.6834	0.6733	0.6683	0.6683	0.6784	0.6910	0.6960	0.6935	(40)
HLP (average)												0.6876	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.1348 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
82.5173	81.2772	79.4702	76.0128	73.4613	70.6159	68.9985	70.7919	72.7577	75.8128	79.3445	82.2011	(42a)

Hot water usage for baths

25.9306	25.5455	25.0032	24.0033	23.2545	22.4243	21.9759	22.5144	23.1007	23.9891	25.0096	25.8429	(42b)

Hot water usage for other uses

36.4921	35.1651	33.8381	32.5112	31.1842	29.8572	29.8572	31.1842	32.5112	33.8381	35.1651	36.4921	(42c)

Average daily hot water use (litres/day)	133.2946 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.9400	141.9879	138.3115	132.5272	127.9000	122.8974	120.8316	124.4905	128.3696	133.6401	139.5193	144.5362	(44)
Energy conte	229.5496	202.1888	212.5797	181.4231	172.1780	151.1167	146.1353	154.1452	158.2926	181.3483	198.7708	226.3088	(45)
Energy content (annual)										Total = Sum(45)m =		2214.0368	

Distribution loss (46)m = 0.15 x (45)m

34.4324	30.3283	31.8870	27.2135	25.8267	22.6675	21.9203	23.1218	23.7439	27.2023	29.8156	33.9463	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)

Total per year (kWh/year) = Sum(64)m = 2461.0688 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

93.1099	82.3881	87.4674	76.5664	74.0338	66.4895	65.3746	68.0379	68.8755	77.0830	82.3345	92.0323	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

21.5047	19.1002	15.5334	11.7598	8.7906	7.4214	8.0190	10.4234	13.9903	17.7639	20.7331	22.1023	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

278.8333	281.7267	274.4354	258.9131	239.3189	220.9031	208.6002	205.7068	212.9981	228.5205	248.1147	266.5304	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	(71)

Water heating gains (Table 5)

125.1477	122.6013	117.5637	106.3422	99.5078	92.3465	87.8691	91.4488	95.6604	103.6061	114.3535	123.6993	(72)

Total internal gains

518.1243	516.0669	500.1711	469.6536	440.2559	413.3096	397.1270	400.2177	415.2875	442.5292	475.8399	504.9707	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5900	9.5462	0.6300	0.8270	0.7700	12.3738	(74)
Northeast	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(75)
Northwest	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(81)

Solar gains 69.4528	148.6778	276.6041	477.3240	638.3689	663.6861	627.6104	484.0300	333.4428	179.5688	89.3871	58.2939	(83)
Total gains 587.5771	664.7447	776.7752	946.9776	1078.6248	1076.9957	1024.7374	884.2477	748.7303	622.0980	565.2270	563.2647	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.2822	76.2822	76.8316	78.5282	78.8183	80.0003	80.6047	80.6047	79.4049	77.9544	77.3889	77.6706	
alpha	6.0855	6.0855	6.1221	6.2352	6.2546	6.3334	6.3736	6.3736	6.2937	6.1970	6.1593	6.1780	
util living area	0.9523	0.9151	0.8170	0.6098	0.4269	0.3197	0.2609	0.3073	0.4846	0.7655	0.9164	0.9604	(86)
MIT	20.4877	20.6359	20.8375	20.9735	20.9971	20.9996	20.9999	20.9998	20.9955	20.9203	20.6918	20.4562	(87)
Th 2	20.3354	20.3354	20.3399	20.3533	20.3555	20.3645	20.3689	20.3689	20.3600	20.3488	20.3443	20.3466	(88)
util rest of house	0.9439	0.9018	0.7950	0.5824	0.4005	0.2937	0.2339	0.2760	0.4477	0.7329	0.9011	0.9533	(89)
MIT 2	19.7510	19.9303	20.1689	20.3280	20.3531	20.3642	20.3689	20.3688	20.3565	20.2729	20.0092	19.7217	(90)
Living area fraction									fLA = Living area / (4) =			0.4663	(91)
MIT	20.0946	20.2593	20.4807	20.6290	20.6534	20.6605	20.6631	20.6630	20.6545	20.5748	20.3275	20.0642	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0946	20.2593	20.4807	20.6290	20.6534	20.6605	20.6631	20.6630	20.6545	20.5748	20.3275	20.0642	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9404	0.9002	0.7998	0.5942	0.4127	0.3059	0.2465	0.2906	0.4648	0.7445	0.9007	0.9498	(94)
Useful gains	552.5820	598.3955	621.2894	562.6696	445.1856	329.4043	252.6245	256.9595	347.9863	463.1695	509.0750	534.9752	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	750.1804	739.2834	684.3902	572.7824	446.2351	329.5308	252.6499	257.0288	349.5347	492.9470	626.8071	744.4884	(97)
Space heating kWh	147.0132	94.6766	46.9470	7.2812	0.7808	0.0000	0.0000	0.0000	0.0000	22.1544	84.7671	155.8778	(98a)

Space heating requirement - total per year (kWh/year) 559.4982

Solar heating kWh

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)

Solar heating contribution - total per year (kWh/year) 0.0000

Space heating kWh

147.0132	94.6766	46.9470	7.2812	0.7808	0.0000	0.0000	0.0000	0.0000	22.1544	84.7671	155.8778	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 559.4982

Space heating per m2 (98c) / (4) = 8.5289 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	147.0132	94.6766	46.9470	7.2812	0.7808	0.0000	0.0000	0.0000	0.0000	22.1544	84.7671	155.8778	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	147.0132	94.6766	46.9470	7.2812	0.7808	0.0000	0.0000	0.0000	0.0000	22.1544	84.7671	155.8778	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	12.1045	10.9331	12.1045	11.7141	12.1045	11.7141	12.1045	12.1045	11.7141	12.1045	11.7141	12.1045	(231)
Lighting	18.8229	15.1004	13.5963	9.9612	7.6943	6.2863	7.0190	9.1236	11.8506	15.5487	17.5622	19.3460	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.3335	-24.2496	-40.7429	-53.0154	-61.7317	-58.2186	-57.7804	-50.9772	-41.3377	-29.2830	-16.9564	-12.3241	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4576	-6.4518	-15.8354	-29.2573	-40.7194	-40.3248	-40.3981	-31.3264	-21.1298	-10.2536	-3.6695	-1.9361	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												559.4982	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2461.0688	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)													
mechanical ventilation fans (SFP = 0.7420)												142.5210	(230a)
Total electricity for the above, kWh/year												142.5210	(231)
Electricity for lighting (calculated in Appendix L)												151.9116	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-704.7104	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2610.2892	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	559.4982	25.1600	140.7697	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	25.1600	619.2049	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	142.5210	25.1600	35.8583	(249)
Energy for lighting	151.9116	25.1600	38.2210	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.9505	25.1600	-115.9752	
PV Unit electricity exported	-243.7598	5.8100	-14.1624	
Total			-130.1376	(252)
Total energy cost			703.9163	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	559.4982	0.1585	88.6595	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2461.0688	0.1413	347.7259	(264)
Space and water heating			436.3854	(265)
Pumps, fans and electric keep-hot	142.5210	0.1387	19.7694	(267)
Energy for lighting	151.9116	0.1443	21.9255	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.9505	0.1321	-60.8840	
PV Unit electricity exported	-243.7598	0.1225	-29.8531	
Total			-90.7371	(269)
Total CO2, kg/year			387.3433	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	559.4982	1.5865	887.6647	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	1.5225	3746.8812	(278)
Space and water heating			4634.5458	(279)
Pumps, fans and electric keep-hot	142.5210	1.5128	215.6057	(281)
Energy for lighting	151.9116	1.5338	233.0071	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.9505	1.4880	-685.9054	
PV Unit electricity exported	-243.7598	0.4495	-109.5580	
Total			-795.4634	(283)
Total Primary energy kWh/year			4287.6952	(286)

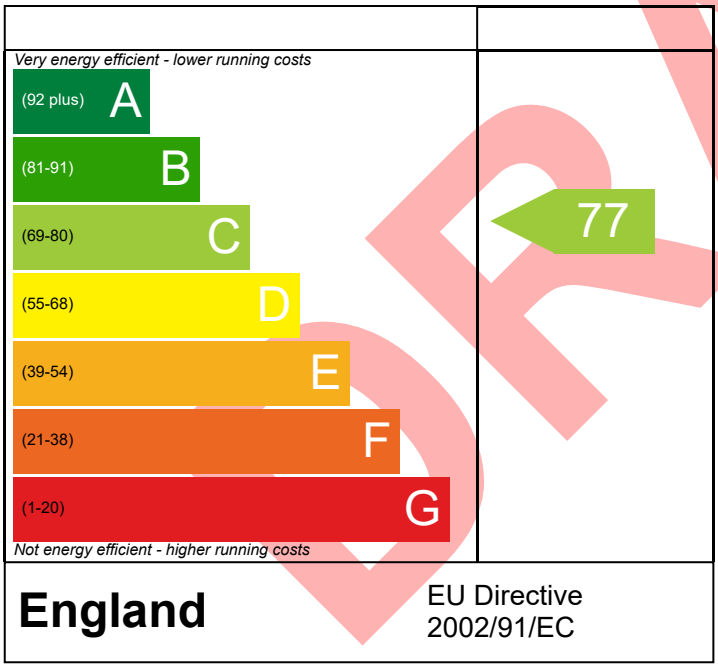
Predicted Energy Assessment

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	65.6 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

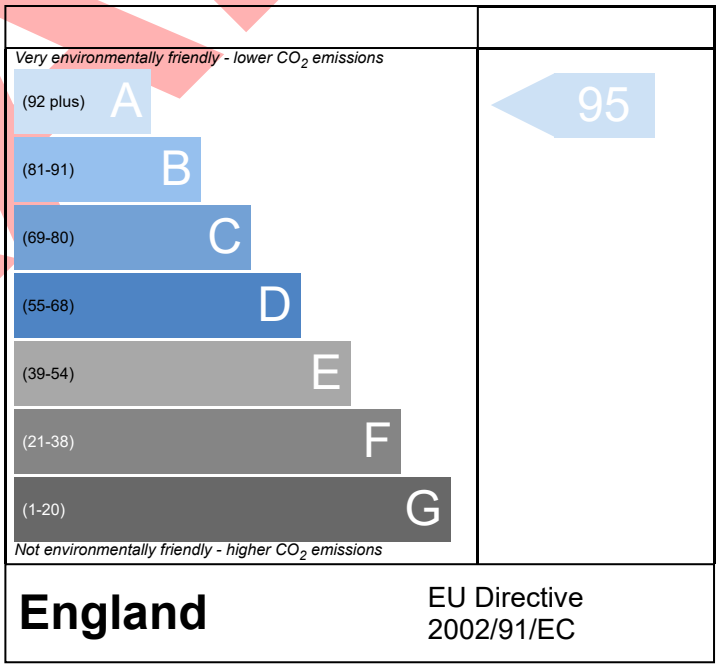
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:28

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	71 m^2
Site Reference	Unit 166 L05_Copy	Plot Reference	Unit 166 L05_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*10.3 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	4.64 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*55.61 kWh$_{PE}$/m^2*	
Dwelling primary energy	52.51 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*18.0 kWh/m^2*	
Dwelling fabric energy efficiency	17.1 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	11	0.14 **(!)**
Party wall: Party Wall (1)	52.62	0 **(!)**
Party wall: Party Wall (2)	15.55	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	11.81	North East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.92 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 166 L05_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 166 L05_Copy	**Prop Type Ref**	Unit 166 L05
Property			

SAP Rating	80 C	**DER**	4.64	**TER**	10.30
Environmental	96 A	**% DER < TER**			54.95
CO_2 Emissions (t/year)	0.33	**DFEE**	17.06	**TFEE**	17.98
Compliance Check	See BREL	**% DFEE < TFEE**			5.14
% DPER < TPER	5.58	**DPER**	52.51	**TPER**	55.61

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.9800	(1b)	x 2.4000	(2b) =	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		170.3520	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14111.0700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		198.8035 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545

E4 Jamb	13.9200	0.0500	0.6960	
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.8660 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.2026	16.0392	15.8758	15.0589	14.8955	14.0786	14.0786	13.9153	14.4054	14.8955	15.2223	15.5490	(38)
Heat transfer coeff	34.2027	34.0393	33.8759	33.0590	32.8956	32.0787	32.0787	31.9154	32.4055	32.8956	33.2224	33.5491	(39)

Average = Sum(39)m / 12 = 33.0182

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4819	0.4796	0.4773	0.4658	0.4634	0.4519	0.4519	0.4496	0.4565	0.4634	0.4681	0.4727	(40)
HLP (average)												0.4652	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2697 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day) 138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)

Energy content (annual) Total = Sum(45)m = 2297.5146

Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)

Total per year (kWh/year) = Sum(64)m = 2544.5466 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(75)

Solar gains	48.1118	97.9329	176.4440	289.7718	389.5101	415.2590	388.4663	309.6898	214.9998	119.6818	60.5371	39.2905	(83)
Total gains	594.4583	642.1364	703.7861	784.8198	853.3337	850.5024	806.5649	731.0038	652.3178	585.8947	562.0348	571.6354	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.6034	115.1535	115.7089	118.5680	119.1569	122.1913	122.1913	122.8168	120.9592	119.1569	117.9849	116.8358	
alpha	8.6402	8.6769	8.7139	8.9045	8.9438	9.1461	9.1461	9.1878	9.0639	8.9438	8.8657	8.7891	
util living area													
	0.8775	0.8131	0.6885	0.5091	0.3585	0.2414	0.1750	0.2008	0.3428	0.5819	0.7916	0.8914	(86)
MIT	20.8955	20.9454	20.9859	20.9990	21.0000	21.0000	21.0000	21.0000	21.0000	20.9975	20.9643	20.8857	(87)
Th 2	20.5375	20.5396	20.5417	20.5523	20.5544	20.5651	20.5651	20.5672	20.5608	20.5544	20.5502	20.5460	(88)
util rest of house													
	0.8633	0.7958	0.6685	0.4904	0.3413	0.2250	0.1577	0.1819	0.3210	0.5575	0.7712	0.8782	(89)
MIT 2	20.4234	20.4818	20.5277	20.5514	20.5544	20.5651	20.5651	20.5672	20.5608	20.5523	20.5139	20.4203	(90)
Living area fraction										fLA = Living area / (4) =		0.4060	(91)
MIT	20.6151	20.6700	20.7137	20.7331	20.7353	20.7417	20.7417	20.7429	20.7391	20.7331	20.6968	20.6093	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6151	20.6700	20.7137	20.7331	20.7353	20.7417	20.7417	20.7429	20.7391	20.7331	20.6968	20.6093	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8657	0.8008	0.6760	0.4979	0.3483	0.2316	0.1647	0.1896	0.3298	0.5673	0.7780	0.8801	(94)
Useful gains	514.6438	514.2072	475.7927	390.7925	297.2070	197.0168	132.8596	138.6063	215.1380	332.4041	437.2668	503.1190	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	558.0190	536.7995	481.5030	391.1911	297.2225	197.0170	132.8596	138.6063	215.1442	333.3337	451.7174	550.5165	(97)
Space heating kWh													
	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(98a)
Space heating requirement - total per year (kWh/year)												98.3601	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												98.3601	
Space heating per m2											(98c) / (4) =	1.3857	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)
Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.8048	-26.6478	-43.2456	-54.4944	-64.0203	-61.6099	-60.6290	-54.7463	-44.7493	-32.6681	-19.3717	-14.1696	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.4726	-8.1139	-18.0130	-29.9352	-41.8274	-42.9674	-42.3587	-34.2994	-23.4325	-12.3679	-4.8722	-2.6645	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	98.3601	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2544.5466	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	154.2094	(230a)
Total electricity for the above, kWh/year	154.2094	(231)
Electricity for lighting (calculated in Appendix L)	163.7369	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-757.4814	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2203.3717	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	98.3601	16.4900	16.2196	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	16.4900	419.5957	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	16.4900	25.4291	(249)
Energy for lighting	163.7369	16.4900	27.0002	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.1568	16.4900	-81.3216	
PV Unit electricity exported	-264.3246	5.5900	-14.7757	
Total			-96.0973	(252)
Total energy cost			392.1474	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2172	(257)
SAP value		80.2689	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	98.3601	0.1606	15.7950	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			375.3396	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.1568	0.1323	-65.2544	
PV Unit electricity exported	-264.3246	0.1234	-32.6244	
Total			-97.8788	(269)
Total CO2, kg/year			322.4838	(272)
CO2 emissions per m2			4.5400	(273)
EI value			96.2741	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14111.0700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 198.8035 (35)
List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4	Jamb	13.9200	0.0500	0.6960
E7	Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18	Party wall between dwellings	5.4000	0.0600	0.3240
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.8660 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3659	16.3659	16.0392	15.0589	14.8955	14.2420	13.9153	13.9153	14.5688	15.3857	15.7124	15.5490	(38)
Heat transfer coeff	34.3660	34.3660	34.0393	33.0590	32.8956	32.2421	31.9154	31.9154	32.5689	33.3858	33.7125	33.5491	(39)

Average = Sum(39)m / 12 = 33.1679

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4842	0.4842	0.4796	0.4658	0.4634	0.4542	0.4496	0.4496	0.4588	0.4704	0.4750	0.4727	(40)
HLP (average)												0.4673	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2697 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day) 138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
										Total per year (kWh/year) = Sum(64)m =		2544.5466	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)													
	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains													
	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(75)

Solar gains	42.7730	92.6022	174.0550	301.5827	403.2921	419.0362	396.3745	305.8819	210.3213	112.3593	55.2465	35.7661	(83)
Total gains	589.1195	636.8057	701.3971	796.6307	867.1157	854.2796	814.4731	727.1958	647.6393	578.5722	556.7443	568.1110	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.0586	114.0586	115.1535	118.5680	119.1569	121.5721	122.8168	122.8168	120.3524	117.4076	116.2696	116.8358	
alpha	8.6039	8.6039	8.6769	8.9045	8.9438	9.1048	9.1878	9.1878	9.0235	8.8272	8.7513	8.7891	
util living area													
	0.8948	0.8436	0.7313	0.5425	0.3907	0.2944	0.2390	0.2721	0.4123	0.6468	0.8263	0.9072	(86)
MIT	20.8725	20.9227	20.9763	20.9982	20.9999	21.0000	21.0000	21.0000	20.9999	20.9935	20.9463	20.8626	(87)
Th 2	20.5354	20.5354	20.5396	20.5523	20.5544	20.5630	20.5672	20.5672	20.5587	20.5481	20.5438	20.5460	(88)
util rest of house													
	0.8819	0.8278	0.7122	0.5242	0.3738	0.2779	0.2221	0.2531	0.3901	0.6222	0.8073	0.8955	(89)
MIT 2	20.3944	20.4521	20.5153	20.5506	20.5544	20.5629	20.5672	20.5672	20.5586	20.5421	20.4880	20.3930	(90)
Living area fraction										fLA = Living area / (4) =		0.4060	(91)
MIT	20.5885	20.6432	20.7024	20.7323	20.7353	20.7404	20.7429	20.7429	20.7378	20.7254	20.6741	20.5837	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5885	20.6432	20.7024	20.7323	20.7353	20.7404	20.7429	20.7429	20.7378	20.7254	20.6741	20.5837	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8835	0.8316	0.7190	0.5316	0.3807	0.2846	0.2290	0.2608	0.3991	0.6319	0.8129	0.8965	(94)
Useful gains	520.4584	529.5388	504.3299	423.4968	330.0802	243.1167	186.4792	189.6703	258.4856	365.5902	452.5648	509.3180	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	573.5183	561.6502	514.0764	424.2235	330.1165	243.1185	186.4794	189.6709	258.5247	368.0921	474.4733	566.4323	(97)
Space heating kWh													
	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930	(98a)
Space heating requirement - total per year (kWh/year)												128.9856	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												128.9856	
Space heating per m2										(98c) / (4) =		1.8172	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)

Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-15.2338	-25.6721	-43.2787	-56.7922	-66.2633	-62.5005	-62.0252	-54.7629	-44.4553	-31.3120	-18.0261	-13.1034 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.9401	-7.5576	-17.9590	-32.2559	-44.6250	-44.1582	-44.2385	-34.3187	-23.1566	-11.4806	-4.2984	-2.3312 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	128.9856 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2544.5466 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	154.2094 (230a)
Total electricity for the above, kWh/year	154.2094 (231)
Electricity for lighting (calculated in Appendix L)	163.7369 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-762.7453 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2228.7332 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	128.9856	25.1600	32.4528	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	25.1600	640.2079	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	25.1600	38.7991	(249)
Energy for lighting	163.7369	25.1600	41.1962	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.4255	25.1600	-124.1459	
PV Unit electricity exported	-269.3198	5.8100	-15.6475	
Total			-139.7933	(252)
Total energy cost			612.8627	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	128.9856	0.1600	20.6366	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			380.1811	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.4255	0.1320	-65.1384	
PV Unit electricity exported	-269.3198	0.1229	-33.1064	
Total			-98.2448	(269)
Total CO2, kg/year			326.9594	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	128.9856	1.5921	205.3619	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	1.5225	3874.0629	(278)
Space and water heating			4079.4248	(279)
Pumps, fans and electric keep-hot	154.2094	1.5128	233.2880	(281)
Energy for lighting	163.7369	1.5338	251.1452	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.4255	1.4878	-734.0970	
PV Unit electricity exported	-269.3198	0.4511	-121.5003	
Total			-855.5973	(283)
Total Primary energy kWh/year			3708.2608	(286)

SAP 10 EPC IMPROVEMENTS

Unit 166 L05_Copy

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 80
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£753	£753	£0
Space heating	£71	£71	£0
Water heating	£640	£640	£0
Lighting	£41	£41	£0
Generated (PV)	-£140	-£140	£0
Total cost of fuels	£613	£613	£0
Total cost of uses	£612	£612	£0
Delivered energy	31 kWh/m²	31 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	52 kWh/m²	52 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14111.0700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		198.8035 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.8660 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.2026	16.0392	15.8758	15.0589	14.8955	14.0786	14.0786	13.9153	14.4054	14.8955	15.2223	15.5490	(38)
Heat transfer coeff	34.2027	34.0393	33.8759	33.0590	32.8956	32.0787	32.0787	31.9154	32.4055	32.8956	33.2224	33.5491	(39)
Average = Sum(39)m / 12 =												33.0182	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4819	0.4796	0.4773	0.4658	0.4634	0.4519	0.4519	0.4496	0.4565	0.4634	0.4681	0.4727	(40)
HLP (average)												0.4652	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.2697 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)

Hot water usage for baths

26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)

Hot water usage for other uses

37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day)		138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
									Total per year (kWh/year) = Sum(64)m =		2544.5466	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast				11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(75)
Solar gains	48.1118	97.9329	176.4440	289.7718	389.5101	415.2590	388.4663	309.6898	214.9998	119.6818	60.5371	39.2905	(83)
Total gains	594.4583	642.1364	703.7861	784.8198	853.3337	850.5024	806.5649	731.0038	652.3178	585.8947	562.0348	571.6354	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.6034	115.1535	115.7089	118.5680	119.1569	122.1913	122.1913	122.8168	120.9592	119.1569	117.9849	116.8358	
alpha	8.6402	8.6769	8.7139	8.9045	8.9438	9.1461	9.1461	9.1878	9.0639	8.9438	8.8657	8.7891	
util living area	0.8775	0.8131	0.6885	0.5091	0.3585	0.2414	0.1750	0.2008	0.3428	0.5819	0.7916	0.8914	(86)
MIT	20.8955	20.9454	20.9859	20.9990	21.0000	21.0000	21.0000	21.0000	21.0000	20.9975	20.9643	20.8857	(87)
Th 2	20.5375	20.5396	20.5417	20.5523	20.5544	20.5651	20.5651	20.5672	20.5608	20.5544	20.5502	20.5460	(88)
util rest of house	0.8633	0.7958	0.6685	0.4904	0.3413	0.2250	0.1577	0.1819	0.3210	0.5575	0.7712	0.8782	(89)
MIT 2	20.4234	20.4818	20.5277	20.5514	20.5544	20.5651	20.5651	20.5672	20.5608	20.5523	20.5139	20.4203	(90)
Living area fraction									fLA = Living area / (4) =			0.4060	(91)
MIT	20.6151	20.6700	20.7137	20.7331	20.7353	20.7417	20.7417	20.7429	20.7391	20.7331	20.6968	20.6093	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6151	20.6700	20.7137	20.7331	20.7353	20.7417	20.7417	20.7429	20.7391	20.7331	20.6968	20.6093	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8657	0.8008	0.6760	0.4979	0.3483	0.2316	0.1647	0.1896	0.3298	0.5673	0.7780	0.8801	(94)
Useful gains	514.6438	514.2072	475.7927	390.7925	297.2070	197.0168	132.8596	138.6063	215.1380	332.4041	437.2668	503.1190	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	558.0190	536.7995	481.5030	391.1911	297.2225	197.0170	132.8596	138.6063	215.1442	333.3337	451.7174	550.5165	(97)
Space heating kWh	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(98a)
Space heating requirement - total per year (kWh/year)												98.3601	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												98.3601	
Space heating per m2										(98c) / (4) =		1.3857	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)
Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.8048	-26.6478	-43.2456	-54.4944	-64.0203	-61.6099	-60.6290	-54.7463	-44.7493	-32.6681	-19.3717	-14.1696	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.4726	-8.1139	-18.0130	-29.9352	-41.8274	-42.9674	-42.3587	-34.2994	-23.4325	-12.3679	-4.8722	-2.6645	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												98.3601	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2544.5466	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	154.2094	(230a)
Total electricity for the above, kWh/year	154.2094	(231)
Electricity for lighting (calculated in Appendix L)	163.7369	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-757.4814	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2203.3717	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	98.3601	16.4900	16.2196	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	16.4900	419.5957	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	16.4900	25.4291	(249)
Energy for lighting	163.7369	16.4900	27.0002	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.1568	16.4900	-81.3216	
PV Unit electricity exported	-264.3246	5.5900	-14.7757	
Total			-96.0973	(252)
Total energy cost			392.1474	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2172	(257)
SAP value		80.2689	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	98.3601	0.1606	15.7950	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			375.3396	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.1568	0.1323	-65.2544	
PV Unit electricity exported	-264.3246	0.1234	-32.6244	
Total			-97.8788	(269)
Total CO2, kg/year			322.4838	(272)
CO2 emissions per m2			4.5400	(273)
EI value			96.2741	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 14111.0700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.8035 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	1.8660 (36)
Point Thermal bridges (36a) =	0.0000
Total fabric heat loss (33) + (36) + (36a) =	18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3659	16.3659	16.0392	15.0589	14.8955	14.2420	13.9153	13.9153	14.5688	15.3857	15.7124	15.5490	(38)
Heat transfer coeff	34.3660	34.3660	34.0393	33.0590	32.8956	32.2421	31.9154	31.9154	32.5689	33.3858	33.7125	33.5491	(39)
Average = Sum(39)m / 12 =												33.1679	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4842	0.4842	0.4796	0.4658	0.4634	0.4542	0.4496	0.4496	0.4588	0.4704	0.4750	0.4727	(40)
HLP (average)												0.4673	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2697 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)
Average daily hot water use (litres/day)												138.3203	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
									Total per year (kWh/year) = Sum(64)m =			2544.5466	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(75)

Solar gains	42.7730	92.6022	174.0550	301.5827	403.2921	419.0362	396.3745	305.8819	210.3213	112.3593	55.2465	35.7661	(83)
Total gains	589.1195	636.8057	701.3971	796.6307	867.1157	854.2796	814.4731	727.1958	647.6393	578.5722	556.7443	568.1110	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.0586	114.0586	115.1535	118.5680	119.1569	121.5721	122.8168	122.8168	120.3524	117.4076	116.2696	116.8358	
alpha	8.6039	8.6039	8.6769	8.9045	8.9438	9.1048	9.1878	9.1878	9.0235	8.8272	8.7513	8.7891	
util living area	0.8948	0.8436	0.7313	0.5425	0.3907	0.2944	0.2390	0.2721	0.4123	0.6468	0.8263	0.9072	(86)
MIT	20.8725	20.9227	20.9763	20.9982	20.9999	21.0000	21.0000	21.0000	20.9999	20.9935	20.9463	20.8626	(87)
Th 2	20.5354	20.5354	20.5396	20.5523	20.5544	20.5630	20.5672	20.5672	20.5587	20.5481	20.5438	20.5460	(88)
util rest of house	0.8819	0.8278	0.7122	0.5242	0.3738	0.2779	0.2221	0.2531	0.3901	0.6222	0.8073	0.8955	(89)
MIT 2	20.3944	20.4521	20.5153	20.5506	20.5544	20.5629	20.5672	20.5672	20.5586	20.5421	20.4880	20.3930	(90)
Living area fraction										fLA = Living area / (4) =		0.4060	(91)
MIT	20.5885	20.6432	20.7024	20.7323	20.7353	20.7404	20.7429	20.7429	20.7378	20.7254	20.6741	20.5837	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5885	20.6432	20.7024	20.7323	20.7353	20.7404	20.7429	20.7429	20.7378	20.7254	20.6741	20.5837	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8835	0.8316	0.7190	0.5316	0.3807	0.2846	0.2290	0.2608	0.3991	0.6319	0.8129	0.8965	(94)
Useful gains	520.4584	529.5388	504.3299	423.4968	330.0802	243.1167	186.4792	189.6703	258.4856	365.5902	452.5648	509.3180	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	573.5183	561.6502	514.0764	424.2235	330.1165	243.1185	186.4794	189.6709	258.5247	368.0921	474.4733	566.4323	(97)
Space heating kWh	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930	(98a)
Space heating requirement - total per year (kWh/year)												128.9856	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												128.9856	
Space heating per m2											(98c) / (4) =	1.8172	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													

	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972 (231)
Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-15.2338	-25.6721	-43.2787	-56.7922	-66.2633	-62.5005	-62.0252	-54.7629	-44.4553	-31.3120	-18.0261	-13.1034 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.9401	-7.5576	-17.9590	-32.2559	-44.6250	-44.1582	-44.2385	-34.3187	-23.1566	-11.4806	-4.2984	-2.3312 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	128.9856 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2544.5466 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	154.2094 (230a)
Total electricity for the above, kWh/year	154.2094 (231)
Electricity for lighting (calculated in Appendix L)	163.7369 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-762.7453 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2228.7332 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	128.9856	25.1600	32.4528	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	25.1600	640.2079	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	25.1600	38.7991	(249)
Energy for lighting	163.7369	25.1600	41.1962	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.4255	25.1600	-124.1459	
PV Unit electricity exported	-269.3198	5.8100	-15.6475	
Total			-139.7933	(252)
Total energy cost			612.8627	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	128.9856	0.1600	20.6366	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			380.1811	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.4255	0.1320	-65.1384	
PV Unit electricity exported	-269.3198	0.1229	-33.1064	
Total			-98.2448	(269)
Total CO2, kg/year			326.9594	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	128.9856	1.5921	205.3619	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	1.5225	3874.0629	(278)
Space and water heating			4079.4248	(279)

Pumps, fans and electric keep-hot	154.2094	1.5128	233.2880	(281)
Energy for lighting	163.7369	1.5338	251.1452	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.4255	1.4878	-734.0970	
PV Unit electricity exported	-269.3198	0.4511	-121.5003	
Total			-855.5973	(283)
Total Primary energy kWh/year			3708.2608	(286)

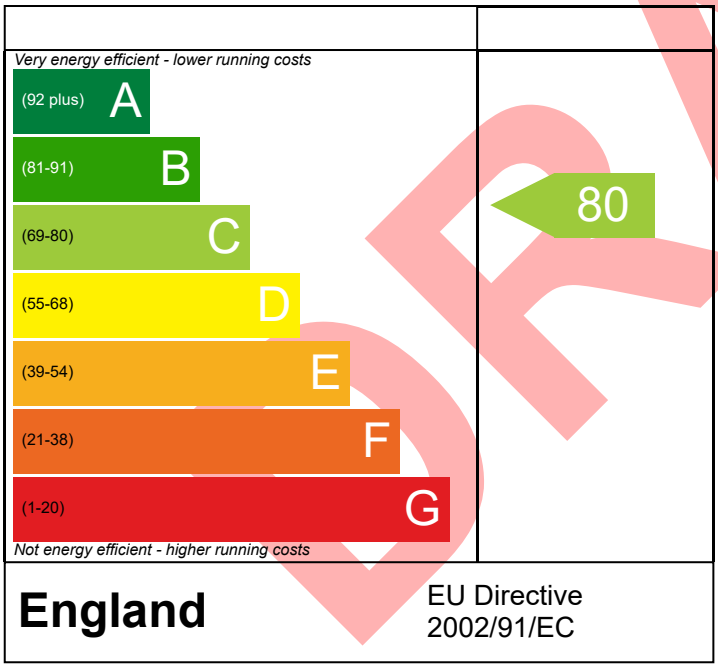
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	70.98 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

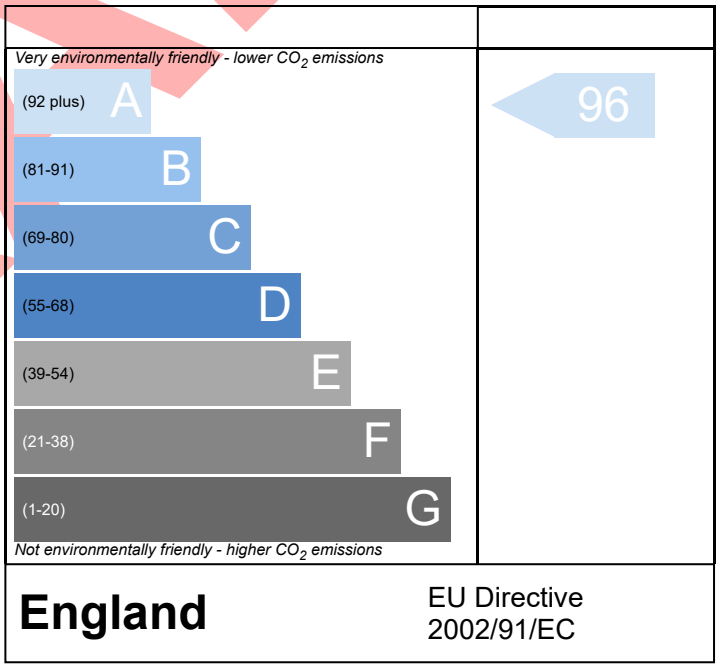
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:31

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	66 m^2
Site Reference	Unit 167 L05_Copy	Plot Reference	Unit 167 L05_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.14 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	5.32 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*60.16 kWh_{PE}/m^2*	
Dwelling primary energy	59.44 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*21.4 kWh/m^2*	
Dwelling fabric energy efficiency	21.6 kWh/m^2	FAIL

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	25.12	0.14 **(!)**
Party wall: Party Wall (1)	55.02	0 **(!)**
Party wall: Party Wall (2)	3.85	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SE, Opening Type 1	11.81	South East	0.83	1.3
NE, Opening Type 1	7.88	North East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.86 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 167 L05_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 167 L05_Copy	**Prop Type Ref**	Unit 167 L05
Property			

SAP Rating	78 C	**DER**	5.32	**TER**	11.14
Environmental	96 A	**% DER < TER**			52.24
CO_2 Emissions (t/year)	0.36	**DFEE**	21.59	**TFEE**	21.38
Compliance Check	See BREL	**% DFEE < TFEE**			-0.98
% DPER < TPER	1.20	**DPER**	59.44	**TPER**	60.16

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.4100	(1b)	x 2.4000	(2b) =	159.3840	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.4100					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		159.3840	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.8100	19.6900	25.1200	0.1400	3.5168	14.0000	351.6800	(29a)
Total net area of external elements Aum(A, m2)			44.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.8485			(33)
Party Wall 1			55.0200	0.0000	0.0000	20.0000	1100.4000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.4100			80.0000	5312.8000	(32d)
Party Ceiling 1			66.4100			80.0000	5312.8000	(32b)
Internal Wall 1			140.4500			9.0000	1264.0500	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13418.7300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.0589 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240

E4 Jamb	23.2000	0.0500	1.1600	
E7 Party floor between dwellings (in blocks of flats)	16.5900	0.0700	1.1613	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	21.8000	0.0000	0.0000	
E16 Corner (normal)	5.4000	0.0900	0.4860	
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				3.5553 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	31.4038 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.9138	15.7461	15.5785	14.7402	14.5726	13.7343	13.7343	13.5667	14.0696	14.5726	14.9079	15.2432	(38)
Heat transfer coeff	47.3176	47.1500	46.9823	46.1441	45.9764	45.1382	45.1382	44.9705	45.4735	45.9764	46.3117	46.6470	(39)
Average = Sum(39)m / 12 =												46.1022	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7125	0.7100	0.7075	0.6948	0.6923	0.6797	0.6797	0.6772	0.6847	0.6923	0.6974	0.7024	(40)
HLP (average)												0.6942	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.1559	(42)
Hot water usage for mixer showers	83.0050	81.7576	79.9399	76.4620	73.8955	71.0332	69.4063	71.2103	73.1878	76.2609	79.8135	82.6870	(42a)
Hot water usage for baths	26.0831	25.6958	25.1503	24.1445	23.3913	22.5562	22.1051	22.6468	23.2366	24.1302	25.1567	25.9950	(42b)
Hot water usage for other uses	36.7088	35.3739	34.0390	32.7042	31.3693	30.0344	30.0344	31.3693	32.7042	34.0390	35.3739	36.7088	(42c)
Average daily hot water use (litres/day)												134.0826	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7969	142.8273	139.1292	133.3107	128.6561	123.6239	121.5459	125.2264	129.1285	134.4302	140.3441	145.3907	(44)
Energy conte	230.9067	203.3841	213.8364	182.4956	173.1958	152.0100	146.9993	155.0565	159.2284	182.4205	199.9459	227.6467	(45)
Energy content (annual)											Total = Sum(45)m =	2227.1258	
Distribution loss (46)m = 0.15 x (45)m	34.6360	30.5076	32.0755	27.3743	25.9794	22.8015	22.0499	23.2585	23.8843	27.3631	29.9919	34.1470	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
										Total per year (kWh/year) = Sum(64)m =		2474.1578	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	93.5611	82.7855	87.8852	76.9230	74.3722	66.7865	65.6619	68.3409	69.1866	77.4394	82.7252	92.4772	(65)

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5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7302	19.3006	15.6963	11.8831	8.8827	7.4992	8.1031	10.5328	14.1371	17.9502	20.9506	22.3341	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.7577	284.6815	277.3137	261.6285	241.8288	223.2199	210.7880	207.8643	215.2321	230.9172	250.7169	269.3258	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	(71)
Water heating gains (Table 5)	125.7542	123.1928	118.1253	106.8375	99.9627	92.7591	88.2552	91.8561	96.0926	104.0853	114.8961	124.2973	(72)
Total internal gains	522.4518	520.3846	504.3451	473.5589	443.8841	416.6880	400.3562	403.4629	418.6715	446.1625	479.7734	509.1670	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(75)
Southeast	11.8100	36.7938	0.6300	0.8270	0.7700	156.8932	(77)

Solar gains	188.9949	332.5911	483.3882	646.4144	767.3690	780.8797	744.9195	651.7680	539.3863	375.2206	228.3142	160.4838	(83)
Total gains	711.4468	852.9757	987.7333	1119.9732	1211.2531	1197.5676	1145.2757	1055.2309	958.0577	821.3831	708.0876	669.6508	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.7745	79.0546	79.3367	80.7780	81.0725	82.5781	82.5781	82.8860	81.9692	81.0725	80.4855	79.9070	
alpha	6.2516	6.2703	6.2891	6.3852	6.4048	6.5052	6.5052	6.5257	6.4646	6.4048	6.3657	6.3271	
util living area	0.9030	0.8075	0.6675	0.4956	0.3527	0.2412	0.1734	0.1960	0.3273	0.5744	0.8198	0.9213	(86)
MIT	20.6897	20.8522	20.9540	20.9930	20.9993	21.0000	21.0000	21.0000	20.9997	20.9866	20.8667	20.6491	(87)
Th 2	20.3298	20.3320	20.3342	20.3454	20.3476	20.3588	20.3588	20.3610	20.3543	20.3476	20.3432	20.3387	(88)
util rest of house	0.8881	0.7855	0.6410	0.4695	0.3281	0.2171	0.1481	0.1688	0.2968	0.5404	0.7950	0.9085	(89)
MIT 2	19.9885	20.1767	20.2890	20.3392	20.3471	20.3588	20.3588	20.3610	20.3541	20.3361	20.2070	19.9486	(90)
Living area fraction										fLA = Living area / (4) =		0.3439	(91)
MIT	20.2297	20.4090	20.5177	20.5640	20.5714	20.5793	20.5793	20.5808	20.5761	20.5598	20.4339	20.1896	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2297	20.4090	20.5177	20.5640	20.5714	20.5793	20.5793	20.5808	20.5761	20.5598	20.4339	20.1896	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8857	0.7881	0.6484	0.4782	0.3365	0.2254	0.1568	0.1782	0.3073	0.5516	0.7986	0.9054	(94)
Useful gains	630.1308	672.2506	640.4892	535.6178	407.6196	269.8816	179.6187	188.0104	294.3932	453.0509	565.4734	606.2927	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	753.7551	731.2498	658.5834	538.2263	407.8736	269.8945	179.6196	188.0124	294.4927	457.9172	617.5145	745.8656	(97)
Space heating kWh	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(98a)
Space heating requirement - total per year (kWh/year)												292.0855	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												292.0855	
Space heating per m2										(98c) / (4) =		4.3982	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5604	10.4416	11.5604	11.1874	11.5604	11.1874	11.5604	11.5604	11.1874	11.5604	11.1874	11.5604	(231)
Lighting	19.0203	15.2588	13.7389	10.0657	7.7750	6.3523	7.0926	9.2193	11.9749	15.7117	17.7464	19.5489	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.9020	-25.1650	-40.7355	-51.2571	-60.2242	-57.9694	-57.0463	-51.4863	-42.0498	-30.6941	-18.2779	-13.4134	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.0531	-7.3297	-16.5280	-27.6662	-38.7205	-39.7876	-39.2248	-31.7520	-21.6853	-11.4048	-4.3848	-2.3228	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

Space heating fuel - main system 1	292.0855	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2474.1578	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.1139	(230a)
Total electricity for the above, kWh/year	136.1139	(231)
Electricity for lighting (calculated in Appendix L)	153.5048	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-708.0805	(233)
Wind generation	0.0000	(234)

Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2347.7816	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	292.0855	16.4900	48.1649	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	16.4900	407.9886	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	136.1139	16.4900	22.4452	(249)
Energy for lighting	153.5048	16.4900	25.3129	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.2208	16.4900	-76.5500	
PV Unit electricity exported	-243.8596	5.5900	-13.6318	
Total			-90.1818	(252)
Total energy cost			413.7299	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.3369	(257)
SAP value		78.3290	
SAP rating (Section 12)		78	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	292.0855	0.1601	46.7656	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2474.1578	0.1413	349.5790	(264)
Space and water heating			396.3446	(265)
Pumps, fans and electric keep-hot	136.1139	0.1387	18.8807	(267)
Energy for lighting	153.5048	0.1443	22.1555	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.2208	0.1323	-61.4360	
PV Unit electricity exported	-243.8596	0.1232	-30.0483	
Total			-91.4843	(269)
Total CO2, kg/year			345.8964	(272)
CO2 emissions per m2			5.2100	(273)
EI value			95.8397	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		66.4100 (1b)	x	2.4000 (2b)	=	159.3840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.4100						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.3840	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.8100	19.6900	25.1200	0.1400	3.5168	14.0000	351.6800	(29a)
Total net area of external elements Aum(A, m2)			44.8100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.8485			(33)
Party Wall 1			55.0200	0.0000	0.0000	20.0000	1100.4000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.4100			80.0000	5312.8000	(32d)
Party Ceiling 1			66.4100			80.0000	5312.8000	(32b)
Internal Wall 1			140.4500			9.0000	1264.0500	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13418.7300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 202.0589 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.5900	0.0700	1.1613
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	21.8000	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.5553 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 31.4038 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.0814	16.0814	15.7461	14.7402	14.5726	13.9020	13.5667	13.5667	14.2373	15.0755	15.4108	15.2432	(38)
Heat transfer coeff	47.4853	47.4853	47.1500	46.1441	45.9764	45.3058	44.9705	44.9705	45.6411	46.4794	46.8147	46.6470	(39)

Average = Sum(39)m / 12 = 46.2558

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7150	0.7150	0.7100	0.6948	0.6923	0.6822	0.6772	0.6772	0.6873	0.6999	0.7049	0.7024	(40)
HLP (average)												0.6965	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1559 (42)
Hot water usage for mixer showers

83.0050	81.7576	79.9399	76.4620	73.8955	71.0332	69.4063	71.2103	73.1878	76.2609	79.8135	82.6870	(42a)

Hot water usage for baths

26.0831	25.6958	25.1503	24.1445	23.3913	22.5562	22.1051	22.6468	23.2366	24.1302	25.1567	25.9950	(42b)

Hot water usage for other uses

36.7088	35.3739	34.0390	32.7042	31.3693	30.0344	30.0344	31.3693	32.7042	34.0390	35.3739	36.7088	(42c)

Average daily hot water use (litres/day) 134.0826 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7969	142.8273	139.1292	133.3107	128.6561	123.6239	121.5459	125.2264	129.1285	134.4302	140.3441	145.3907	(44)
Energy conte	230.9067	203.3841	213.8364	182.4956	173.1958	152.0100	146.9993	155.0565	159.2284	182.4205	199.9459	227.6467	(45)
Energy content (annual)										Total = Sum(45)m =		2227.1258	
Distribution loss (46)m = 0.15 x (45)m	34.6360	30.5076	32.0755	27.3743	25.9794	22.8015	22.0499	23.2585	23.8843	27.3631	29.9919	34.1470	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
									Total per year (kWh/year) = Sum(64)m =		2474.1578	(64)
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

93.5611	82.7855	87.8852	76.9230	74.3722	66.7865	65.6619	68.3409	69.1866	77.4394	82.7252	92.4772	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	21.7302	19.3006	15.6963	11.8831	8.8827	7.4992	8.1031	10.5328	14.1371	17.9502	20.9506	22.3341	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	281.7577	284.6815	277.3137	261.6285	241.8288	223.2199	210.7880	207.8643	215.2321	230.9172	250.7169	269.3258	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	(71)

Water heating gains (Table 5)

	125.7542	123.1928	118.1253	106.8375	99.9627	92.7591	88.2552	91.8561	96.0926	104.0853	114.8961	124.2973	(72)

Total internal gains

	522.4518	520.3846	504.3451	473.5589	443.8841	416.6880	400.3562	403.4629	418.6715	446.1625	479.7734	509.1670	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(75)
Southeast	11.8100	33.4622	0.6300	0.8270	0.7700	142.6869	(77)

Solar gains	171.2264	321.1940	487.0707	684.6820	805.1181	796.7968	769.3033	653.9832	538.3810	359.9515	212.5016	148.7415	(83)
Total gains	693.6782	841.5786	991.4157	1158.2409	1249.0022	1213.4847	1169.6595	1057.4461	957.0525	806.1140	692.2750	657.9085	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.4964	78.4964	79.0546	80.7780	81.0725	82.2725	82.8860	82.8860	81.6681	80.1952	79.6208	79.9070	
alpha	6.2331	6.2331	6.2703	6.3852	6.4048	6.4848	6.5257	6.5257	6.4445	6.3463	6.3081	6.3271	
util living area	0.9197	0.8349	0.7014	0.5179	0.3787	0.2911	0.2345	0.2636	0.3905	0.6359	0.8514	0.9346	(86)
MIT	20.6348	20.8103	20.9354	20.9903	20.9988	20.9998	21.0000	20.9999	20.9989	20.9734	20.8218	20.5957	(87)
Th 2	20.3276	20.3276	20.3320	20.3454	20.3476	20.3566	20.3610	20.3610	20.3521	20.3409	20.3365	20.3387	(88)
util rest of house	0.9069	0.8149	0.6763	0.4930	0.3548	0.2672	0.2100	0.2365	0.3598	0.6026	0.8294	0.9237	(89)
MIT 2	19.9210	20.1249	20.2669	20.3365	20.3466	20.3564	20.3610	20.3610	20.3513	20.3170	20.1505	19.8839	(90)
Living area fraction									fLA = Living area / (4) =			0.3439	(91)
MIT	20.1665	20.3606	20.4968	20.5613	20.5709	20.5777	20.5808	20.5807	20.5740	20.5428	20.3814	20.1287	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1665	20.3606	20.4968	20.5613	20.5709	20.5777	20.5808	20.5807	20.5740	20.5428	20.3814	20.1287	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9035	0.8159	0.6826	0.5012	0.3630	0.2754	0.2184	0.2458	0.3703	0.6129	0.8309	0.9199	(94)
Useful gains	626.7471	686.6584	676.6978	580.5582	453.3870	334.1970	255.4576	259.9424	354.4406	494.0662	575.2427	605.2281	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	772.4183	762.6420	702.3835	584.2461	453.8286	334.2536	255.4673	259.9631	354.8138	503.9653	645.1697	766.3484	(97)
Space heating kWh	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(98a)
Space heating requirement - total per year (kWh/year)												359.1203	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												359.1203	
Space heating per m2										(98c) / (4) =		5.4076	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
Efficiency of water heater												100.0000	(216)

(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5604	10.4416	11.5604	11.1874	11.5604	11.1874	11.5604	11.5604	11.1874	11.5604	11.1874	11.5604	(231)
Lighting	19.0203	15.2588	13.7389	10.0657	7.7750	6.3523	7.0926	9.2193	11.9749	15.7117	17.7464	19.5489	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.4219	-24.2665	-40.8039	-53.4428	-62.3485	-58.8113	-58.3661	-51.5020	-41.7727	-29.4443	-17.0276	-12.4092	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.5668	-6.7960	-16.4400	-29.7978	-41.3079	-40.8915	-40.9673	-31.7699	-21.4298	-10.5575	-3.8409	-2.0189	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	359.1203	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2474.1578	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.1139	(230a)
Total electricity for the above, kWh/year	136.1139	(231)
Electricity for lighting (calculated in Appendix L)	153.5048	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-713.0011	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2409.8957	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	359.1203	25.1600	90.3547	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	25.1600	622.4981	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	136.1139	25.1600	34.2463	(249)
Energy for lighting	153.5048	25.1600	38.6218	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.6169	25.1600	-116.8976	
PV Unit electricity exported	-248.3842	5.8100	-14.4311	
Total			-131.3287	(252)
Total energy cost			654.3921	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	359.1203	0.1596	57.3260	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2474.1578	0.1413	349.5790	(264)
Space and water heating			406.9051	(265)
Pumps, fans and electric keep-hot	136.1139	0.1387	18.8807	(267)
Energy for lighting	153.5048	0.1443	22.1555	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.6169	0.1320	-61.3475	
PV Unit electricity exported	-248.3842	0.1227	-30.4782	
Total			-91.8258	(269)
Total CO2, kg/year			356.1155	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	359.1203	1.5908	571.2751	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	1.5225	3766.8228	(278)
Space and water heating			4338.0979	(279)
Pumps, fans and electric keep-hot	136.1139	1.5128	205.9132	(281)
Energy for lighting	153.5048	1.5338	235.4508	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.6169	1.4879	-691.2826	
PV Unit electricity exported	-248.3842	0.4503	-111.8546	
Total			-803.1371	(283)
Total Primary energy kWh/year			3976.3248	(286)

SAP 10 EPC IMPROVEMENTS

Unit 167 L05_Copy

Current energy efficiency rating: C 78
Current environmental impact rating: A 96

N Solar water heating — Not applicable
U Solar photovoltaic panels — Not applicable
V2 Wind turbine — Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 78
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£786	£786	£0
Space heating	£125	£125	£0
Water heating	£622	£622	£0
Lighting	£39	£39	£0
Generated (PV)	-£131	-£131	£0
Total cost of fuels	£655	£655	£0
Total cost of uses	£655	£655	£0
Delivered energy	36 kWh/m²	36 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	60 kWh/m²	60 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.4100	(1b)	x 2.4000	(2b) =	159.3840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.4100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		159.3840	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.8100	19.6900	25.1200	0.1400	3.5168	14.0000	351.6800	(29a)
Total net area of external elements Aum(A, m2)			44.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.8485			(33)
Party Wall 1			55.0200	0.0000	0.0000	20.0000	1100.4000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.4100			80.0000	5312.8000	(32d)
Party Ceiling 1			66.4100			80.0000	5312.8000	(32b)
Internal Wall 1			140.4500			9.0000	1264.0500	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13418.7300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 202.0589 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240	
E4 Jamb	23.2000	0.0500	1.1600	
E7 Party floor between dwellings (in blocks of flats)	16.5900	0.0700	1.1613	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	21.8000	0.0000	0.0000	
E16 Corner (normal)	5.4000	0.0900	0.4860	
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.5553 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 31.4038 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.9138	15.7461	15.5785	14.7402	14.5726	13.7343	13.7343	13.5667	14.0696	14.5726	14.9079	15.2432	(38)
Heat transfer coeff	47.3176	47.1500	46.9823	46.1441	45.9764	45.1382	45.1382	44.9705	45.4735	45.9764	46.3117	46.6470	(39)
Average = Sum(39)m / 12 =												46.1022	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7125	0.7100	0.7075	0.6948	0.6923	0.6797	0.6797	0.6772	0.6847	0.6923	0.6974	0.7024	(40)
HLP (average)												0.6942	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1559 (42)
Hot water usage for mixer showers

83.0050	81.7576	79.9399	76.4620	73.8955	71.0332	69.4063	71.2103	73.1878	76.2609	79.8135	82.6870	(42a)

Hot water usage for baths

26.0831	25.6958	25.1503	24.1445	23.3913	22.5562	22.1051	22.6468	23.2366	24.1302	25.1567	25.9950	(42b)

Hot water usage for other uses

36.7088	35.3739	34.0390	32.7042	31.3693	30.0344	30.0344	31.3693	32.7042	34.0390	35.3739	36.7088	(42c)

Average daily hot water use (litres/day) 134.0826 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7969	142.8273	139.1292	133.3107	128.6561	123.6239	121.5459	125.2264	129.1285	134.4302	140.3441	145.3907	(44)
Energy conte	230.9067	203.3841	213.8364	182.4956	173.1958	152.0100	146.9993	155.0565	159.2284	182.4205	199.9459	227.6467	(45)
Energy content (annual)										Total = Sum(45)m =		2227.1258	
Distribution loss (46)m = 0.15 x (45)m	34.6360	30.5076	32.0755	27.3743	25.9794	22.8015	22.0499	23.2585	23.8843	27.3631	29.9919	34.1470	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
									Total per year (kWh/year) = Sum(64)m =			2474.1578	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	93.5611	82.7855	87.8852	76.9230	74.3722	66.7865	65.6619	68.3409	69.1866	77.4394	82.7252	92.4772	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7302	19.3006	15.6963	11.8831	8.8827	7.4992	8.1031	10.5328	14.1371	17.9502	20.9506	22.3341	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.7577	284.6815	277.3137	261.6285	241.8288	223.2199	210.7880	207.8643	215.2321	230.9172	250.7169	269.3258	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	(71)
Water heating gains (Table 5)													

	125.7542	123.1928	118.1253	106.8375	99.9627	92.7591	88.2552	91.8561	96.0926	104.0853	114.8961	124.2973	(72)
Total internal gains													
	522.4518	520.3846	504.3451	473.5589	443.8841	416.6880	400.3562	403.4629	418.6715	446.1625	479.7734	509.1670	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(75)
Southeast	11.8100	36.7938	0.6300	0.8270	0.7700	156.8932	(77)

Solar gains	188.9949	332.5911	483.3882	646.4144	767.3690	780.8797	744.9195	651.7680	539.3863	375.2206	228.3142	160.4838	(83)
Total gains	711.4468	852.9757	987.7333	1119.9732	1211.2531	1197.5676	1145.2757	1055.2309	958.0577	821.3831	708.0876	669.6508	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.7745	79.0546	79.3367	80.7780	81.0725	82.5781	82.5781	82.8860	81.9692	81.0725	80.4855	79.9070	
alpha	6.2516	6.2703	6.2891	6.3852	6.4048	6.5052	6.5052	6.5257	6.4646	6.4048	6.3657	6.3271	
util living area													
	0.9030	0.8075	0.6675	0.4956	0.3527	0.2412	0.1734	0.1960	0.3273	0.5744	0.8198	0.9213	(86)
MIT	20.6897	20.8522	20.9540	20.9930	20.9993	21.0000	21.0000	21.0000	20.9997	20.9866	20.8667	20.6491	(87)
Th 2	20.3298	20.3320	20.3342	20.3454	20.3476	20.3588	20.3588	20.3610	20.3543	20.3476	20.3432	20.3387	(88)
util rest of house													
	0.8881	0.7855	0.6410	0.4695	0.3281	0.2171	0.1481	0.1688	0.2968	0.5404	0.7950	0.9085	(89)
MIT 2	19.9885	20.1767	20.2890	20.3392	20.3471	20.3588	20.3588	20.3610	20.3541	20.3361	20.2070	19.9486	(90)
Living area fraction										fLA = Living area / (4) =		0.3439	(91)
MIT	20.2297	20.4090	20.5177	20.5640	20.5714	20.5793	20.5793	20.5808	20.5761	20.5598	20.4339	20.1896	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2297	20.4090	20.5177	20.5640	20.5714	20.5793	20.5793	20.5808	20.5761	20.5598	20.4339	20.1896	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8857	0.7881	0.6484	0.4782	0.3365	0.2254	0.1568	0.1782	0.3073	0.5516	0.7986	0.9054	(94)
Useful gains	630.1308	672.2506	640.4892	535.6178	407.6196	269.8816	179.6187	188.0104	294.3932	453.0509	565.4734	606.2927	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	753.7551	731.2498	658.5834	538.2263	407.8736	269.8945	179.6196	188.0124	294.4927	457.9172	617.5145	745.8656	(97)
Space heating kWh													
	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(98a)
Space heating requirement - total per year (kWh/year)												292.0855	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												292.0855	
Space heating per m2											(98c) / (4) =	4.3982	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5604	10.4416	11.5604	11.1874	11.5604	11.1874	11.5604	11.5604	11.1874	11.5604	11.1874	11.5604	(231)
Lighting	19.0203	15.2588	13.7389	10.0657	7.7750	6.3523	7.0926	9.2193	11.9749	15.7117	17.7464	19.5489	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.9020	-25.1650	-40.7355	-51.2571	-60.2242	-57.9694	-57.0463	-51.4863	-42.0498	-30.6941	-18.2779	-13.4134	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													

(233b)m	-3.0531	-7.3297	-16.5280	-27.6662	-38.7205	-39.7876	-39.2248	-31.7520	-21.6853	-11.4048	-4.3848	-2.3228	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	292.0855	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2474.1578	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.1139	(230a)
Total electricity for the above, kWh/year	136.1139	(231)
Electricity for lighting (calculated in Appendix L)	153.5048	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-708.0805	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2347.7816	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	292.0855	16.4900	48.1649	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	16.4900	407.9886	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	136.1139	16.4900	22.4452	(249)
Energy for lighting	153.5048	16.4900	25.3129	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.2208	16.4900	-76.5500	
PV Unit electricity exported	-243.8596	5.5900	-13.6318	
Total			-90.1818	(252)
Total energy cost			413.7299	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.3369	(257)
SAP value		78.3290	
SAP rating (Section 12)		78	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	292.0855	0.1601	46.7656	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2474.1578	0.1413	349.5790	(264)
Space and water heating			396.3446	(265)
Pumps, fans and electric keep-hot	136.1139	0.1387	18.8807	(267)
Energy for lighting	153.5048	0.1443	22.1555	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.2208	0.1323	-61.4360	
PV Unit electricity exported	-243.8596	0.1232	-30.0483	
Total			-91.4843	(269)
Total CO2, kg/year			345.8964	(272)
CO2 emissions per m2			5.2100	(273)
EI value			95.8397	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		66.4100 (1b)	x	2.4000 (2b)	=	159.3840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.4100						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.3840	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.8100	19.6900	25.1200	0.1400	3.5168	14.0000	351.6800	(29a)
Total net area of external elements Aum(A, m2)			44.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.8485			(33)
Party Wall 1			55.0200	0.0000	0.0000	20.0000	1100.4000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.4100			80.0000	5312.8000	(32d)
Party Ceiling 1			66.4100			80.0000	5312.8000	(32b)
Internal Wall 1			140.4500			9.0000	1264.0500	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13418.7300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.0589 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.5900	0.0700	1.1613
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	21.8000	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.5553 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	31.4038 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.0814	16.0814	15.7461	14.7402	14.5726	13.9020	13.5667	13.5667	14.2373	15.0755	15.4108	15.2432	(38)
Heat transfer coeff	47.4853	47.4853	47.1500	46.1441	45.9764	45.3058	44.9705	44.9705	45.6411	46.4794	46.8147	46.6470	(39)
Average = Sum(39)m / 12 =												46.2558	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7150	0.7150	0.7100	0.6948	0.6923	0.6822	0.6772	0.6772	0.6873	0.6999	0.7049	0.7024	(40)
HLP (average)												0.6965	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1559	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
83.0050	81.7576	79.9399	76.4620	73.8955	71.0332	69.4063	71.2103	73.1878	76.2609	79.8135	82.6870	(42a)

Hot water usage for baths

26.0831	25.6958	25.1503	24.1445	23.3913	22.5562	22.1051	22.6468	23.2366	24.1302	25.1567	25.9950	(42b)

Hot water usage for other uses

36.7088	35.3739	34.0390	32.7042	31.3693	30.0344	30.0344	31.3693	32.7042	34.0390	35.3739	36.7088	(42c)

Average daily hot water use (litres/day)	134.0826 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7969	142.8273	139.1292	133.3107	128.6561	123.6239	121.5459	125.2264	129.1285	134.4302	140.3441	145.3907	(44)
Energy conte	230.9067	203.3841	213.8364	182.4956	173.1958	152.0100	146.9993	155.0565	159.2284	182.4205	199.9459	227.6467	(45)
Energy content (annual)										Total = Sum(45)m =		2227.1258	
Distribution loss (46)m = 0.15 x (45)m	34.6360	30.5076	32.0755	27.3743	25.9794	22.8015	22.0499	23.2585	23.8843	27.3631	29.9919	34.1470	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)

Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
										Total per year (kWh/year) = Sum(64)m =		2474.1578	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	93.5611	82.7855	87.8852	76.9230	74.3722	66.7865	65.6619	68.3409	69.1866	77.4394	82.7252	92.4772	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.7302	19.3006	15.6963	11.8831	8.8827	7.4992	8.1031	10.5328	14.1371	17.9502	20.9506	22.3341	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	281.7577	284.6815	277.3137	261.6285	241.8288	223.2199	210.7880	207.8643	215.2321	230.9172	250.7169	269.3258	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	(71)
Water heating gains (Table 5)													
	125.7542	123.1928	118.1253	106.8375	99.9627	92.7591	88.2552	91.8561	96.0926	104.0853	114.8961	124.2973	(72)
Total internal gains													
	522.4518	520.3846	504.3451	473.5589	443.8841	416.6880	400.3562	403.4629	418.6715	446.1625	479.7734	509.1670	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(75)
Southeast	11.8100	33.4622	0.6300	0.8270	0.7700	142.6869	(77)

Solar gains	171.2264	321.1940	487.0707	684.6820	805.1181	796.7968	769.3033	653.9832	538.3810	359.9515	212.5016	148.7415	(83)
Total gains	693.6782	841.5786	991.4157	1158.2409	1249.0022	1213.4847	1169.6595	1057.4461	957.0525	806.1140	692.2750	657.9085	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.4964	78.4964	79.0546	80.7780	81.0725	82.2725	82.8860	82.8860	81.6681	80.1952	79.6208	79.9070	
alpha	6.2331	6.2331	6.2703	6.3852	6.4048	6.4848	6.5257	6.5257	6.4445	6.3463	6.3081	6.3271	
util living area													
	0.9197	0.8349	0.7014	0.5179	0.3787	0.2911	0.2345	0.2636	0.3905	0.6359	0.8514	0.9346	(86)
MIT	20.6348	20.8103	20.9354	20.9903	20.9988	20.9998	21.0000	20.9999	20.9989	20.9734	20.8218	20.5957	(87)
Th 2	20.3276	20.3276	20.3320	20.3454	20.3476	20.3566	20.3610	20.3610	20.3521	20.3409	20.3365	20.3387	(88)
util rest of house													
	0.9069	0.8149	0.6763	0.4930	0.3548	0.2672	0.2100	0.2365	0.3598	0.6026	0.8294	0.9237	(89)
MIT 2	19.9210	20.1249	20.2669	20.3365	20.3466	20.3564	20.3610	20.3610	20.3513	20.3170	20.1505	19.8839	(90)
Living area fraction										fLA = Living area / (4) =		0.3439	(91)
MIT	20.1665	20.3606	20.4968	20.5613	20.5709	20.5777	20.5808	20.5807	20.5740	20.5428	20.3814	20.1287	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1665	20.3606	20.4968	20.5613	20.5709	20.5777	20.5808	20.5807	20.5740	20.5428	20.3814	20.1287	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9035	0.8159	0.6826	0.5012	0.3630	0.2754	0.2184	0.2458	0.3703	0.6129	0.8309	0.9199	(94)
Useful gains	626.7471	686.6584	676.6978	580.5582	453.3870	334.1970	255.4576	259.9424	354.4406	494.0662	575.2427	605.2281	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	772.4183	762.6420	702.3835	584.2461	453.8286	334.2536	255.4673	259.9631	354.8138	503.9653	645.1697	766.3484	(97)
Space heating kWh													
	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(98a)
Space heating requirement - total per year (kWh/year)												359.1203	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												359.1203	
Space heating per m2											(98c) / (4) =	5.4076	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5604	10.4416	11.5604	11.1874	11.5604	11.1874	11.5604	11.5604	11.1874	11.5604	11.1874	11.5604	(231)
Lighting	19.0203	15.2588	13.7389	10.0657	7.7750	6.3523	7.0926	9.2193	11.9749	15.7117	17.7464	19.5489	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.4219	-24.2665	-40.8039	-53.4428	-62.3485	-58.8113	-58.3661	-51.5020	-41.7727	-29.4443	-17.0276	-12.4092	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.5668	-6.7960	-16.4400	-29.7978	-41.3079	-40.8915	-40.9673	-31.7699	-21.4298	-10.5575	-3.8409	-2.0189	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												359.1203	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2474.1578	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)													
mechanical ventilation fans (SFP = 0.7000)												136.1139	(230a)
Total electricity for the above, kWh/year												136.1139	(231)
Electricity for lighting (calculated in Appendix L)												153.5048	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-713.0011	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2409.8957	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	359.1203	25.1600	90.3547	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	25.1600	622.4981	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	136.1139	25.1600	34.2463	(249)
Energy for lighting	153.5048	25.1600	38.6218	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.6169	25.1600	-116.8976	
PV Unit electricity exported	-248.3842	5.8100	-14.4311	
Total			-131.3287	(252)
Total energy cost			654.3921	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	359.1203	0.1596	57.3260	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2474.1578	0.1413	349.5790	(264)
Space and water heating			406.9051	(265)
Pumps, fans and electric keep-hot	136.1139	0.1387	18.8807	(267)
Energy for lighting	153.5048	0.1443	22.1555	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.6169	0.1320	-61.3475	
PV Unit electricity exported	-248.3842	0.1227	-30.4782	
Total			-91.8258	(269)
Total CO2, kg/year			356.1155	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	359.1203	1.5908	571.2751	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	1.5225	3766.8228	(278)
Space and water heating			4338.0979	(279)
Pumps, fans and electric keep-hot	136.1139	1.5128	205.9132	(281)
Energy for lighting	153.5048	1.5338	235.4508	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.6169	1.4879	-691.2826	
PV Unit electricity exported	-248.3842	0.4503	-111.8546	
Total			-803.1371	(283)
Total Primary energy kWh/year			3976.3248	(286)

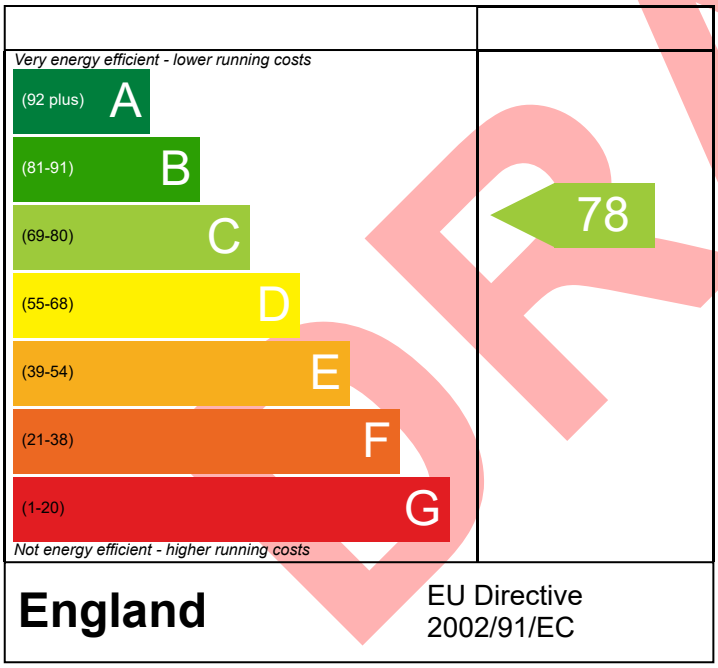
Predicted Energy Assessment

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	66.41 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

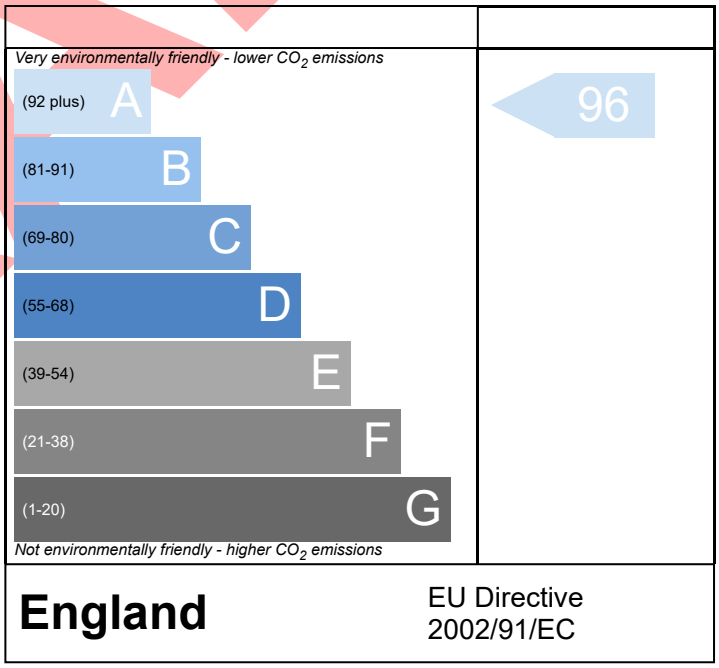
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:32

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	36 m^2
Site Reference	Unit 182 MEZ_Copy	Plot Reference	Unit 182 MEZ_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*24.56 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	11.71 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*133.31 kWh_{PE}/m^2*	
Dwelling primary energy	125.37 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*67.2 kWh/m^2*	
Dwelling fabric energy efficiency	60.3 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.12	Heatloss Floor 1 (0.12)	OK
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	57.75	0.14 **(!)**
Party wall: Party Wall (1)	49.18	0 **(!)**
Party wall: Party Wall (2)	12.49	0 **(!)**
Ground floor: Heatloss Floor 1, Heatloss Floor 1	35.93	0.12

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	5.96	North East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E3: Sill	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.16	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.08	
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0 **(!)**	
Party wall	P2: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.46 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 182 MEZ_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 182 MEZ_Copy	**Prop Type Ref**	Unit 182 MEZ
Property			

SAP Rating	67 D	**DER**	11.71	**TER**	24.56
Environmental	93 A	**% DER < TER**			52.32
CO_2 Emissions (t/year)	0.42	**DFEE**	60.30	**TFEE**	67.24
Compliance Check	See BREL	**% DFEE < TFEE**			10.33
% DPER < TPER	5.96	**DPER**	125.37	**TPER**	133.31

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	35.9300 (1b)	x	4.7500 (2b)	=	170.6675	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	35.9300					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.6675	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			5.9600	1.2357	7.3650			(27)
Heatloss Floor 1			35.9300	0.1200	4.3116	75.0000	2694.7500	(28a)
External Wall 1	63.7100	5.9600	57.7500	0.1400	8.0850	14.0000	808.5000	(29a)
Total net area of external elements Aum(A, m2)			99.6400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	19.7616			(33)
Party Wall 1			49.1800	0.0000	0.0000	20.0000	983.6000	(32)
Wall to corridor			12.4900	0.0000	0.0000	20.0000	249.8000	(32)
Party Ceiling 1			35.9300			80.0000	2874.4000	(32b)
Internal Wall 1			103.4900			9.0000	931.4100	(32c)
Internal Floor 1			21.1000			0.0000	0.0000	(32d)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 8542.4600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	237.7529 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	2.4400	0.0500	0.1220	
E3 Sill	2.4400	0.0500	0.1220	
E4 Jamb	9.3000	0.0500	0.4650	
E5 Ground floor (normal)	12.3700	0.1600	1.9792	
E18 Party wall between dwellings	10.3000	0.0600	0.6180	
P1 Party wall - Ground floor	11.1200	0.0800	0.8896	
E6 Intermediate floor within a dwelling	3.9600	0.0000	0.0000	
P2 Party wall - Intermediate floor within a dwelling	9.2800	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.1958 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 23.9574 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	17.0404	16.8609	16.6814	15.7838	15.6042	14.7066	14.7066	14.5271	15.0657	15.6042	15.9633	16.3223	(38)
Heat transfer coeff	40.9978	40.8183	40.6388	39.7412	39.5617	38.6641	38.6641	38.4845	39.0231	39.5617	39.9207	40.2797	(39)

Average = Sum(39)m / 12 = 39.6963

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1410	1.1361	1.1311	1.1061	1.1011	1.0761	1.0761	1.0711	1.0861	1.1011	1.1111	1.1211	(40)
HLP (average)												1.1048	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.3029 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	81.2374	80.0165	78.2375	74.8337	72.3218	69.5205	67.9283	69.6938	71.6292	74.6369	78.1138	80.9261	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	27.9726	26.9554	25.9383	24.9211	23.9039	22.8867	22.8867	23.9039	24.9211	25.9383	26.9554	27.9726	(42c)

Average daily hot water use (litres/day) 100.3278 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.2100	106.9720	104.1758	99.7548	96.2257	92.4072	90.8150	93.5977	96.5503	100.5752	105.0693	108.8987	(44)
Energy conte	172.9619	152.3267	160.1143	136.5593	129.5383	113.6255	109.8329	115.8935	119.0561	136.4795	149.6904	170.5091	(45)
Energy content (annual)										Total = Sum(45)m =		1666.5875	
Distribution loss (46)m = 0.15 x (45)m	25.9443	22.8490	24.0171	20.4839	19.4307	17.0438	16.4749	17.3840	17.8584	20.4719	22.4536	25.5764	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(64)
										Total per year (kWh/year) = Sum(64)m =		1913.6195	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	74.2945	65.8089	70.0226	61.6492	59.8561	54.0237	53.3041	55.3192	55.8294	62.1641	66.0153	73.4789	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.2092	11.7323	9.5414	7.2234	5.3996	4.5586	4.9257	6.4026	8.5936	10.9115	12.7353	13.5764	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	166.3438	168.0699	163.7201	154.4599	142.7706	131.7843	124.4448	122.7187	127.0684	136.3286	148.0179	159.0042	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	(71)
Water heating gains (Table 5)	99.8582	97.9300	94.1165	85.6239	80.4518	75.0329	71.6452	74.3538	77.5408	83.5539	91.6879	98.7620	(72)
Total internal gains	349.5885	347.9095	337.5553	317.4845	298.7993	281.5531	271.1931	273.6524	283.3801	300.9713	322.6185	341.5199	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.9600	11.2829	0.6300	0.8270	0.7700	24.2800	(75)

Solar gains	24.2800	49.4226	89.0437	146.2354	196.5690	209.5634	196.0422	156.2872	108.5012	60.3983	30.5505	19.8282	(83)
Total gains	373.8685	397.3321	426.5990	463.7199	495.3683	491.1165	467.2353	429.9396	391.8813	361.3696	353.1689	361.3482	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.8788	58.1334	58.3902	59.7090	59.9799	61.3724	61.3724	61.6587	60.8077	59.9799	59.4405	58.9106	
alpha	4.8586	4.8756	4.8927	4.9806	4.9987	5.0915	5.0915	5.1106	5.0538	4.9987	4.9627	4.9274	
util living area	0.9753	0.9641	0.9332	0.8475	0.6908	0.4961	0.3627	0.4091	0.6511	0.8824	0.9586	0.9783	(86)
MIT	20.0050	20.1470	20.4046	20.7251	20.9194	20.9880	20.9980	20.9965	20.9557	20.7100	20.3235	19.9914	(87)
Th 2	19.9675	19.9715	19.9756	19.9959	20.0000	20.0204	20.0204	20.0245	20.0122	20.0000	19.9918	19.9837	(88)
util rest of house	0.9685	0.9545	0.9155	0.8112	0.6316	0.4235	0.2827	0.3237	0.5714	0.8450	0.9458	0.9724	(89)
MIT 2	18.8495	19.0293	19.3477	19.7356	19.9377	20.0140	20.0198	20.0233	19.9848	19.7326	19.2672	18.8448	(90)
Living area fraction										fLA = Living area / (4) =		0.7762	(91)
MIT	19.7464	19.8969	20.1681	20.5037	20.6997	20.7701	20.7791	20.7787	20.7385	20.4913	20.0871	19.7348	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7464	19.8969	20.1681	20.5037	20.6997	20.7701	20.7791	20.7787	20.7385	20.4913	20.0871	19.7348	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9668	0.9537	0.9192	0.8305	0.6737	0.4793	0.3448	0.3899	0.6309	0.8646	0.9472	0.9706	(94)
Useful gains	361.4693	378.9284	392.1145	385.1025	333.7535	235.4159	161.1063	167.6549	247.2501	312.4504	334.5268	350.7347	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	633.2708	612.1491	555.4540	461.1427	356.0445	238.5601	161.5814	168.5122	259.0529	391.3149	518.4555	625.7376	(97)
Space heating kWh	202.2203	156.7243	121.5246	54.7490	16.5845	0.0000	0.0000	0.0000	0.0000	58.6751	132.4286	204.6022	(98a)
Space heating requirement - total per year (kWh/year)												947.5086	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	202.2203	156.7243	121.5246	54.7490	16.5845	0.0000	0.0000	0.0000	0.0000	58.6751	132.4286	204.6022	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												947.5086	
Space heating per m2											(98c) / (4) =	26.3710	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 100.0000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	202.2203	156.7243	121.5246	54.7490	16.5845	0.0000	0.0000	0.0000	0.0000	58.6751	132.4286	204.6022	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	202.2203	156.7243	121.5246	54.7490	16.5845	0.0000	0.0000	0.0000	0.0000	58.6751	132.4286	204.6022	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.1215	11.8517	13.1215	12.6982	13.1215	12.6982	13.1215	13.1215	12.6982	13.1215	12.6982	13.1215	(231)
Lighting	11.5620	9.2754	8.3515	6.1187	4.7262	3.8614	4.3114	5.6042	7.2793	9.5508	10.7876	11.8833	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-8.8822	-14.3823	-23.6861	-29.8816	-34.8075	-33.2461	-32.7373	-29.3859	-23.7823	-17.5204	-10.3027	-7.4586	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.2565	-2.9986	-6.9432	-12.3332	-18.1164	-19.0425	-18.7565	-15.1369	-10.3085	-4.9976	-1.8192	-0.9584	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 947.5086 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 100.0000

Water heating fuel used 1913.6195 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)

mechanical ventilation fans (SFP = 0.7420) 154.4950 (230a)

Total electricity for the above, kWh/year 154.4950 (231)

Electricity for lighting (calculated in Appendix L) 93.3118 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation -378.7407 (233)

Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2730.1943	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	947.5086	16.4900	156.2442	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1913.6195	16.4900	315.5559	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	154.4950	16.4900	25.4762	(249)
Energy for lighting	93.3118	16.4900	15.3871	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-266.0730	16.4900	-43.8754	
PV Unit electricity exported	-112.6677	5.5900	-6.2981	
Total			-50.1736	(252)
Total energy cost			462.4898	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	2.0573	(257)
SAP value		66.6514	
SAP rating (Section 12)		67	(258)
SAP band		D	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	947.5086	0.1562	147.9760	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1913.6195	0.1412	270.2448	(264)
Space and water heating			418.2209	(265)
Pumps, fans and electric keep-hot	154.4950	0.1387	21.4304	(267)
Energy for lighting	93.3118	0.1443	13.4678	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-266.0730	0.1323	-35.2109	
PV Unit electricity exported	-112.6677	0.1218	-13.7268	
Total			-48.9376	(269)
Total CO2, kg/year			404.1814	(272)
CO2 emissions per m2			11.2500	(273)
EI value			93.3078	
EI rating			93	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		35.9300 (1b)	x	4.7500 (2b)	=	170.6675	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	35.9300						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.6675	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			5.9600	1.2357	7.3650			(27)
Heatloss Floor 1			35.9300	0.1200	4.3116	75.0000	2694.7500	(28a)
External Wall 1	63.7100	5.9600	57.7500	0.1400	8.0850	14.0000	808.5000	(29a)
Total net area of external elements Aum(A, m2)			99.6400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		19.7616			(33)
Party Wall 1			49.1800	0.0000	0.0000	20.0000	983.6000	(32)
Wall to corridor			12.4900	0.0000	0.0000	20.0000	249.8000	(32)
Party Ceiling 1			35.9300			80.0000	2874.4000	(32b)
Internal Wall 1			103.4900			9.0000	931.4100	(32c)
Internal Floor 1			21.1000			0.0000	0.0000	(32d)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 8542.4600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 237.7529 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	2.4400	0.0500	0.1220
E3 Sill	2.4400	0.0500	0.1220
E4 Jamb	9.3000	0.0500	0.4650
E5 Ground floor (normal)	12.3700	0.1600	1.9792
E18 Party wall between dwellings	10.3000	0.0600	0.6180
P1 Party wall - Ground floor	11.1200	0.0800	0.8896
E6 Intermediate floor within a dwelling	3.9600	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	9.2800	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.1958 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 23.9574 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	17.2199	17.2199	16.8609	15.7838	15.6042	14.8862	14.5271	14.5271	15.2452	16.1428	16.5018	16.3223	(38)
Heat transfer coeff	41.1773	41.1773	40.8183	39.7412	39.5617	38.8436	38.4845	38.4845	39.2026	40.1002	40.4593	40.2797	(39)
Average = Sum(39)m / 12 =												39.8609	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1460	1.1460	1.1361	1.1061	1.1011	1.0811	1.0711	1.0711	1.0911	1.1161	1.1261	1.1211	(40)
HLP (average)												1.1094	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.3029 (42)
Hot water usage for mixer showers

81.2374	80.0165	78.2375	74.8337	72.3218	69.5205	67.9283	69.6938	71.6292	74.6369	78.1138	80.9261	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

27.9726	26.9554	25.9383	24.9211	23.9039	22.8867	22.8867	23.9039	24.9211	25.9383	26.9554	27.9726	(42c)

Average daily hot water use (litres/day) 100.3278 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.2100	106.9720	104.1758	99.7548	96.2257	92.4072	90.8150	93.5977	96.5503	100.5752	105.0693	108.8987	(44)
Energy conte	172.9619	152.3267	160.1143	136.5593	129.5383	113.6255	109.8329	115.8935	119.0561	136.4795	149.6904	170.5091	(45)
Energy content (annual)										Total = Sum(45)m =		1666.5875	
Distribution loss (46)m = 0.15 x (45)m	25.9443	22.8490	24.0171	20.4839	19.4307	17.0438	16.4749	17.3840	17.8584	20.4719	22.4536	25.5764	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(64)
									Total per year (kWh/year) = Sum(64)m =		1913.6195	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

74.2945	65.8089	70.0226	61.6492	59.8561	54.0237	53.3041	55.3192	55.8294	62.1641	66.0153	73.4789	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.2092	11.7323	9.5414	7.2234	5.3996	4.5586	4.9257	6.4026	8.5936	10.9115	12.7353	13.5764	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	166.3438	168.0699	163.7201	154.4599	142.7706	131.7843	124.4448	122.7187	127.0684	136.3286	148.0179	159.0042	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	(71)
Water heating gains (Table 5)													
	99.8582	97.9300	94.1165	85.6239	80.4518	75.0329	71.6452	74.3538	77.5408	83.5539	91.6879	98.7620	(72)
Total internal gains													
	349.5885	347.9095	337.5553	317.4845	298.7993	281.5531	271.1931	273.6524	283.3801	300.9713	322.6185	341.5199	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.9600	10.0309	0.6300	0.8270	0.7700	21.5857	(75)

Solar gains	21.5857	46.7324	87.8381	152.1958	203.5242	211.4696	200.0332	154.3654	106.1401	56.7029	27.8805	18.0496	(83)
Total gains	371.1742	394.6419	425.3934	469.6804	502.3235	493.0227	471.2262	428.0178	389.5202	357.6742	350.4990	359.5695	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.6265	57.6265	58.1334	59.7090	59.9799	61.0888	61.6587	61.6587	60.5293	59.1744	58.6493	58.9106	
alpha	4.8418	4.8418	4.8756	4.9806	4.9987	5.0726	5.1106	5.1106	5.0353	4.9450	4.9100	4.9274	
util living area													
	0.9782	0.9699	0.9464	0.8726	0.7359	0.5934	0.4910	0.5447	0.7454	0.9134	0.9654	0.9810	(86)
MIT	19.9407	20.0529	20.2967	20.6533	20.8816	20.9672	20.9893	20.9827	20.9023	20.6050	20.2385	19.9262	(87)
Th 2	19.9634	19.9634	19.9715	19.9959	20.0000	20.0163	20.0245	20.0245	20.0081	19.9877	19.9796	19.9837	(88)
util rest of house													
	0.9723	0.9619	0.9324	0.8423	0.6836	0.5262	0.4157	0.4645	0.6792	0.8852	0.9548	0.9760	(89)
MIT 2	18.7655	18.9057	19.2129	19.6541	19.9013	19.9947	20.0191	20.0153	19.9356	19.6032	19.1528	18.7624	(90)
Living area fraction									fLA = Living area / (4) =			0.7762	(91)
MIT	19.6777	19.7962	20.0542	20.4297	20.6622	20.7496	20.7722	20.7663	20.6860	20.3808	19.9956	19.6658	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6777	19.7962	20.0542	20.4297	20.6622	20.7496	20.7722	20.7663	20.6860	20.3808	19.9956	19.6658	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9704	0.9604	0.9337	0.8562	0.7190	0.5768	0.4737	0.5259	0.7257	0.8971	0.9550	0.9740	(94)
Useful gains	360.1744	378.9961	397.1787	402.1173	361.1858	284.3546	223.2068	225.0943	282.6587	320.8746	334.7311	350.2362	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	649.6840	638.0929	589.9955	497.9454	394.1210	293.2535	225.9887	229.6085	309.1515	428.3043	541.9746	643.0963	(97)
Space heating kWh													
	215.3952	174.1131	143.4557	68.9962	24.5038	0.0000	0.0000	0.0000	0.0000	79.9277	149.2153	217.8879	(98a)
Space heating requirement - total per year (kWh/year)												1073.4949	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	215.3952	174.1131	143.4557	68.9962	24.5038	0.0000	0.0000	0.0000	0.0000	79.9277	149.2153	217.8879	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1073.4949	
Space heating per m2											(98c) / (4) =	29.8774	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	215.3952	174.1131	143.4557	68.9962	24.5038	0.0000	0.0000	0.0000	0.0000	79.9277	149.2153	217.8879	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	215.3952	174.1131	143.4557	68.9962	24.5038	0.0000	0.0000	0.0000	0.0000	79.9277	149.2153	217.8879	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating

Water heating requirement

	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.1215	11.8517	13.1215	12.6982	13.1215	12.6982	13.1215	13.1215	12.6982	13.1215	12.6982	13.1215	(231)
Lighting	11.5620	9.2754	8.3515	6.1187	4.7262	3.8614	4.3114	5.6042	7.2793	9.5508	10.7876	11.8833	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-8.0302	-13.8544	-23.8224	-31.4380	-36.3008	-33.7527	-33.5328	-29.3952	-23.6199	-16.8760	-9.5788	-6.8841	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.0568	-2.7605	-6.7964	-13.0860	-19.1433	-19.5766	-19.5990	-15.1456	-10.1860	-4.5203	-1.5834	-0.8332	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1073.4949	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	1913.6195	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	154.4950	(230a)
Total electricity for the above, kWh/year	154.4950	(231)
Electricity for lighting (calculated in Appendix L)	93.3118	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-381.3727	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2853.5486	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1073.4949	25.1600	270.0913	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1913.6195	25.1600	481.4667	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	154.4950	25.1600	38.8710	(249)
Energy for lighting	93.3118	25.1600	23.4772	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-267.0854	25.1600	-67.1987	
PV Unit electricity exported	-114.2873	5.8100	-6.6401	
Total			-73.8388	(252)
Total energy cost			740.0674	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1073.4949	0.1555	166.9346	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1913.6195	0.1412	270.2448	(264)
Space and water heating			437.1795	(265)
Pumps, fans and electric keep-hot	154.4950	0.1387	21.4304	(267)
Energy for lighting	93.3118	0.1443	13.4678	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-267.0854	0.1320	-35.2678	
PV Unit electricity exported	-114.2873	0.1212	-13.8554	
Total			-49.1232	(269)
Total CO2, kg/year			422.9544	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1073.4949	1.5757	1691.5461	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1913.6195	1.5222	2912.9178	(278)
Space and water heating			4604.4639	(279)
Pumps, fans and electric keep-hot	154.4950	1.5128	233.7201	(281)
Energy for lighting	93.3118	1.5338	143.1247	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-267.0854	1.4879	-397.3944	
PV Unit electricity exported	-114.2873	0.4448	-50.8345	
Total			-448.2290	(283)
Total Primary energy kWh/year			4533.0797	(286)

SAP 10 EPC IMPROVEMENTS

Unit 182 MEZ_Copy

Current energy efficiency rating: D 67
Current environmental impact rating: A 93

N Solar water heating	Not applicable
U Solar photovoltaic panels	Not applicable
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: D 67
Potential environmental impact rating: A 93

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£814	£814	£0
Space heating	£309	£309	£0
Water heating	£481	£481	£0
Lighting	£23	£23	£0
Generated (PV)	-£74	-£74	£0
Total cost of fuels	£740	£740	£0
Total cost of uses	£739	£739	£0
Delivered energy	79 kWh/m²	79 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	12 kg/m²	12 kg/m²	0 kg/m²
Primary energy	126 kWh/m²	126 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	35.9300 (1b)	x	4.7500 (2b)	=	170.6675	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	35.9300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.6675	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor (20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20)	=	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			5.9600	1.2357	7.3650			(27)
Heatloss Floor 1			35.9300	0.1200	4.3116	75.0000	2694.7500	(28a)
External Wall 1	63.7100	5.9600	57.7500	0.1400	8.0850	14.0000	808.5000	(29a)
Total net area of external elements Aum(A, m2)			99.6400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	19.7616			(33)
Party Wall 1			49.1800	0.0000	0.0000	20.0000	983.6000	(32)
Wall to corridor			12.4900	0.0000	0.0000	20.0000	249.8000	(32)
Party Ceiling 1			35.9300			80.0000	2874.4000	(32b)
Internal Wall 1			103.4900			9.0000	931.4100	(32c)
Internal Floor 1			21.1000			0.0000	0.0000	(32d)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	8542.4600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		237.7529 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.4400	0.0500	0.1220
E3 Sill	2.4400	0.0500	0.1220
E4 Jamb	9.3000	0.0500	0.4650
E5 Ground floor (normal)	12.3700	0.1600	1.9792
E18 Party wall between dwellings	10.3000	0.0600	0.6180
P1 Party wall - Ground floor	11.1200	0.0800	0.8896
E6 Intermediate floor within a dwelling	3.9600	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	9.2800	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.1958 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	23.9574 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	17.0404	16.8609	16.6814	15.7838	15.6042	14.7066	14.7066	14.5271	15.0657	15.6042	15.9633	16.3223	(38)
Heat transfer coeff	40.9978	40.8183	40.6388	39.7412	39.5617	38.6641	38.6641	38.4845	39.0231	39.5617	39.9207	40.2797	(39)
Average = Sum(39)m / 12 =												39.6963	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1410	1.1361	1.1311	1.1061	1.1011	1.0761	1.0761	1.0711	1.0861	1.1011	1.1111	1.1211	(40)
HLP (average)												1.1048	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.3029	(42)
Hot water usage for mixer showers	81.2374	80.0165	78.2375	74.8337	72.3218	69.5205	67.9283	69.6938	71.6292	74.6369	78.1138	80.9261	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	27.9726	26.9554	25.9383	24.9211	23.9039	22.8867	22.8867	23.9039	24.9211	25.9383	26.9554	27.9726	(42c)
Average daily hot water use (litres/day)												100.3278	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.2100	106.9720	104.1758	99.7548	96.2257	92.4072	90.8150	93.5977	96.5503	100.5752	105.0693	108.8987	(44)
Energy conte	172.9619	152.3267	160.1143	136.5593	129.5383	113.6255	109.8329	115.8935	119.0561	136.4795	149.6904	170.5091	(45)
Energy content (annual)										Total = Sum(45)m =		1666.5875	
Distribution loss (46)m = 0.15 x (45)m	25.9443	22.8490	24.0171	20.4839	19.4307	17.0438	16.4749	17.3840	17.8584	20.4719	22.4536	25.5764	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(64)
										Total per year (kWh/year) = Sum(64)m =		1913.6195	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	74.2945	65.8089	70.0226	61.6492	59.8561	54.0237	53.3041	55.3192	55.8294	62.1641	66.0153	73.4789	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.2092	11.7323	9.5414	7.2234	5.3996	4.5586	4.9257	6.4026	8.5936	10.9115	12.7353	13.5764	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	166.3438	168.0699	163.7201	154.4599	142.7706	131.7843	124.4448	122.7187	127.0684	136.3286	148.0179	159.0042	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	(69)

Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	(71)
Water heating gains (Table 5)													
	99.8582	97.9300	94.1165	85.6239	80.4518	75.0329	71.6452	74.3538	77.5408	83.5539	91.6879	98.7620	(72)
Total internal gains													
	349.5885	347.9095	337.5553	317.4845	298.7993	281.5531	271.1931	273.6524	283.3801	300.9713	322.6185	341.5199	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.9600	11.2829	0.6300	0.8270	0.7700	24.2800	(75)

Solar gains	24.2800	49.4226	89.0437	146.2354	196.5690	209.5634	196.0422	156.2872	108.5012	60.3983	30.5505	19.8282	(83)
Total gains	373.8685	397.3321	426.5990	463.7199	495.3683	491.1165	467.2353	429.9396	391.8813	361.3696	353.1689	361.3482	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.8788	58.1334	58.3902	59.7090	59.9799	61.3724	61.3724	61.6587	60.8077	59.9799	59.4405	58.9106	
alpha	4.8586	4.8756	4.8927	4.9806	4.9987	5.0915	5.0915	5.1106	5.0538	4.9987	4.9627	4.9274	
util living area													
	0.9753	0.9641	0.9332	0.8475	0.6908	0.4961	0.3627	0.4091	0.6511	0.8824	0.9586	0.9783	(86)
MIT	20.0050	20.1470	20.4046	20.7251	20.9194	20.9880	20.9980	20.9965	20.9557	20.7100	20.3235	19.9914	(87)
Th 2	19.9675	19.9715	19.9756	19.9959	20.0000	20.0204	20.0204	20.0245	20.0122	20.0000	19.9918	19.9837	(88)
util rest of house													
	0.9685	0.9545	0.9155	0.8112	0.6316	0.4235	0.2827	0.3237	0.5714	0.8450	0.9458	0.9724	(89)
MIT 2	18.8495	19.0293	19.3477	19.7356	19.9377	20.0140	20.0198	20.0233	19.9848	19.7326	19.2672	18.8448	(90)
Living area fraction									fLA = Living area / (4) =			0.7762	(91)
MIT	19.7464	19.8969	20.1681	20.5037	20.6997	20.7701	20.7791	20.7787	20.7385	20.4913	20.0871	19.7348	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7464	19.8969	20.1681	20.5037	20.6997	20.7701	20.7791	20.7787	20.7385	20.4913	20.0871	19.7348	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9668	0.9537	0.9192	0.8305	0.6737	0.4793	0.3448	0.3899	0.6309	0.8646	0.9472	0.9706	(94)
Useful gains	361.4693	378.9284	392.1145	385.1025	333.7535	235.4159	161.1063	167.6549	247.2501	312.4504	334.5268	350.7347	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	633.2708	612.1491	555.4540	461.1427	356.0445	238.5601	161.5814	168.5122	259.0529	391.3149	518.4555	625.7376	(97)
Space heating kWh													
	202.2203	156.7243	121.5246	54.7490	16.5845	0.0000	0.0000	0.0000	0.0000	58.6751	132.4286	204.6022	(98a)
Space heating requirement - total per year (kWh/year)												947.5086	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	202.2203	156.7243	121.5246	54.7490	16.5845	0.0000	0.0000	0.0000	0.0000	58.6751	132.4286	204.6022	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												947.5086	
Space heating per m2											(98c) / (4) =	26.3710	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	202.2203	156.7243	121.5246	54.7490	16.5845	0.0000	0.0000	0.0000	0.0000	58.6751	132.4286	204.6022	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	202.2203	156.7243	121.5246	54.7490	16.5845	0.0000	0.0000	0.0000	0.0000	58.6751	132.4286	204.6022	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.1215	11.8517	13.1215	12.6982	13.1215	12.6982	13.1215	13.1215	12.6982	13.1215	12.6982	13.1215	(231)
Lighting	11.5620	9.2754	8.3515	6.1187	4.7262	3.8614	4.3114	5.6042	7.2793	9.5508	10.7876	11.8833	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-8.8822	-14.3823	-23.6861	-29.8816	-34.8075	-33.2461	-32.7373	-29.3859	-23.7823	-17.5204	-10.3027	-7.4586	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.2565	-2.9986	-6.9432	-12.3332	-18.1164	-19.0425	-18.7565	-15.1369	-10.3085	-4.9976	-1.8192	-0.9584	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	947.5086	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	1913.6195	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	154.4950	(230a)
Total electricity for the above, kWh/year	154.4950	(231)
Electricity for lighting (calculated in Appendix L)	93.3118	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-378.7407	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2730.1943	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	947.5086	16.4900	156.2442	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1913.6195	16.4900	315.5559	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	154.4950	16.4900	25.4762	(249)
Energy for lighting	93.3118	16.4900	15.3871	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-266.0730	16.4900	-43.8754	
PV Unit electricity exported	-112.6677	5.5900	-6.2981	
Total			-50.1736	(252)
Total energy cost			462.4898	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	2.0573	(257)
SAP value		66.6514	
SAP rating (Section 12)		67	(258)
SAP band		D	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	947.5086	0.1562	147.9760	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1913.6195	0.1412	270.2448	(264)
Space and water heating			418.2209	(265)
Pumps, fans and electric keep-hot	154.4950	0.1387	21.4304	(267)
Energy for lighting	93.3118	0.1443	13.4678	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-266.0730	0.1323	-35.2109	
PV Unit electricity exported	-112.6677	0.1218	-13.7268	
Total			-48.9376	(269)
Total CO2, kg/year			404.1814	(272)
CO2 emissions per m2			11.2500	(273)
EI value			93.3078	
EI rating			93	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		35.9300	(1b)	x 4.7500	(2b) =	170.6675	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	35.9300						(4)

Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 170.6675 (5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			5.9600	1.2357	7.3650			(27)
Heatloss Floor 1			35.9300	0.1200	4.3116	75.0000	2694.7500	(28a)
External Wall 1	63.7100	5.9600	57.7500	0.1400	8.0850	14.0000	808.5000	(29a)
Total net area of external elements Aum(A, m2)			99.6400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		19.7616			(33)
Party Wall 1			49.1800	0.0000	0.0000	20.0000	983.6000	(32)
Wall to corridor			12.4900	0.0000	0.0000	20.0000	249.8000	(32)
Party Ceiling 1			35.9300			80.0000	2874.4000	(32b)
Internal Wall 1			103.4900			9.0000	931.4100	(32c)
Internal Floor 1			21.1000			0.0000	0.0000	(32d)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 8542.4600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	237.7529 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.4400	0.0500	0.1220
E3 Sill	2.4400	0.0500	0.1220
E4 Jamb	9.3000	0.0500	0.4650
E5 Ground floor (normal)	12.3700	0.1600	1.9792
E18 Party wall between dwellings	10.3000	0.0600	0.6180
P1 Party wall - Ground floor	11.1200	0.0800	0.8896
E6 Intermediate floor within a dwelling	3.9600	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	9.2800	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.1958 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	23.9574 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	17.2199	17.2199	16.8609	15.7838	15.6042	14.8862	14.5271	14.5271	15.2452	16.1428	16.5018	16.3223	(38)
Heat transfer coeff	41.1773	41.1773	40.8183	39.7412	39.5617	38.8436	38.4845	38.4845	39.2026	40.1002	40.4593	40.2797	(39)
Average = Sum(39)m / 12 =												39.8609	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1460	1.1460	1.1361	1.1061	1.1011	1.0811	1.0711	1.0711	1.0911	1.1161	1.1261	1.1211	(40)
HLP (average)												1.1094	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.3029 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	81.2374	80.0165	78.2375	74.8337	72.3218	69.5205	67.9283	69.6938	71.6292	74.6369	78.1138	80.9261	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	27.9726	26.9554	25.9383	24.9211	23.9039	22.8867	22.8867	23.9039	24.9211	25.9383	26.9554	27.9726	(42c)
Average daily hot water use (litres/day)												100.3278	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.2100	106.9720	104.1758	99.7548	96.2257	92.4072	90.8150	93.5977	96.5503	100.5752	105.0693	108.8987	(44)
Energy conte	172.9619	152.3267	160.1143	136.5593	129.5383	113.6255	109.8329	115.8935	119.0561	136.4795	149.6904	170.5091	(45)
Energy content (annual)										Total = Sum(45)m =		1666.5875	

Distribution loss (46)m = 0.15 x (45)m

	25.9443	22.8490	24.0171	20.4839	19.4307	17.0438	16.4749	17.3840	17.8584	20.4719	22.4536	25.5764	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(64)
										Total per year (kWh/year) = Sum(64)m =		1913.6195	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	74.2945	65.8089	70.0226	61.6492	59.8561	54.0237	53.3041	55.3192	55.8294	62.1641	66.0153	73.4789	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.2092	11.7323	9.5414	7.2234	5.3996	4.5586	4.9257	6.4026	8.5936	10.9115	12.7353	13.5764	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	166.3438	168.0699	163.7201	154.4599	142.7706	131.7843	124.4448	122.7187	127.0684	136.3286	148.0179	159.0042	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	(71)
Water heating gains (Table 5)													
	99.8582	97.9300	94.1165	85.6239	80.4518	75.0329	71.6452	74.3538	77.5408	83.5539	91.6879	98.7620	(72)
Total internal gains													
	349.5885	347.9095	337.5553	317.4845	298.7993	281.5531	271.1931	273.6524	283.3801	300.9713	322.6185	341.5199	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.9600	10.0309	0.6300	0.8270	0.7700	21.5857	(75)

Solar gains	21.5857	46.7324	87.8381	152.1958	203.5242	211.4696	200.0332	154.3654	106.1401	56.7029	27.8805	18.0496	(83)
Total gains	371.1742	394.6419	425.3934	469.6804	502.3235	493.0227	471.2262	428.0178	389.5202	357.6742	350.4990	359.5695	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.6265	57.6265	58.1334	59.7090	59.9799	61.0888	61.6587	61.6587	60.5293	59.1744	58.6493	58.9106	
alpha	4.8418	4.8418	4.8756	4.9806	4.9987	5.0726	5.1106	5.1106	5.0353	4.9450	4.9100	4.9274	
util living area													
	0.9782	0.9699	0.9464	0.8726	0.7359	0.5934	0.4910	0.5447	0.7454	0.9134	0.9654	0.9810	(86)
MIT	19.9407	20.0529	20.2967	20.6533	20.8816	20.9672	20.9893	20.9827	20.9023	20.6050	20.2385	19.9262	(87)
Th 2	19.9634	19.9634	19.9715	19.9959	20.0000	20.0163	20.0245	20.0245	20.0081	19.9877	19.9796	19.9837	(88)
util rest of house													
	0.9723	0.9619	0.9324	0.8423	0.6836	0.5262	0.4157	0.4645	0.6792	0.8852	0.9548	0.9760	(89)
MIT 2	18.7655	18.9057	19.2129	19.6541	19.9013	19.9947	20.0191	20.0153	19.9356	19.6032	19.1528	18.7624	(90)
Living area fraction										fLA = Living area / (4) =		0.7762	(91)
MIT	19.6777	19.7962	20.0542	20.4297	20.6622	20.7496	20.7722	20.7663	20.6860	20.3808	19.9956	19.6658	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6777	19.7962	20.0542	20.4297	20.6622	20.7496	20.7722	20.7663	20.6860	20.3808	19.9956	19.6658	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9704	0.9604	0.9337	0.8562	0.7190	0.5768	0.4737	0.5259	0.7257	0.8971	0.9550	0.9740	(94)
Useful gains	360.1744	378.9961	397.1787	402.1173	361.1858	284.3546	223.2068	225.0943	282.6587	320.8746	334.7311	350.2362	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	649.6840	638.0929	589.9955	497.9454	394.1210	293.2535	225.9887	229.6085	309.1515	428.3043	541.9746	643.0963	(97)
Space heating kWh													
	215.3952	174.1131	143.4557	68.9962	24.5038	0.0000	0.0000	0.0000	0.0000	79.9277	149.2153	217.8879	(98a)
Space heating requirement - total per year (kWh/year)												1073.4949	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	215.3952	174.1131	143.4557	68.9962	24.5038	0.0000	0.0000	0.0000	0.0000	79.9277	149.2153	217.8879	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1073.4949	
Space heating per m2											(98c) / (4) =	29.8774	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	215.3952	174.1131	143.4557	68.9962	24.5038	0.0000	0.0000	0.0000	0.0000	79.9277	149.2153	217.8879	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	215.3952	174.1131	143.4557	68.9962	24.5038	0.0000	0.0000	0.0000	0.0000	79.9277	149.2153	217.8879	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.1215	11.8517	13.1215	12.6982	13.1215	12.6982	13.1215	13.1215	12.6982	13.1215	12.6982	13.1215	(231)
Lighting	11.5620	9.2754	8.3515	6.1187	4.7262	3.8614	4.3114	5.6042	7.2793	9.5508	10.7876	11.8833	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-8.0302	-13.8544	-23.8224	-31.4380	-36.3008	-33.7527	-33.5328	-29.3952	-23.6199	-16.8760	-9.5788	-6.8841	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.0568	-2.7605	-6.7964	-13.0860	-19.1433	-19.5766	-19.5990	-15.1456	-10.1860	-4.5203	-1.5834	-0.8332	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1073.4949	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												1913.6195	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)													
mechanical ventilation fans (SFP = 0.7420)												154.4950	(230a)
Total electricity for the above, kWh/year												154.4950	(231)
Electricity for lighting (calculated in Appendix L)												93.3118	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-381.3727	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2853.5486	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1073.4949	25.1600	270.0913	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1913.6195	25.1600	481.4667	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	154.4950	25.1600	38.8710	(249)
Energy for lighting	93.3118	25.1600	23.4772	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-267.0854	25.1600	-67.1987	
PV Unit electricity exported	-114.2873	5.8100	-6.6401	
Total			-73.8388	(252)
Total energy cost			740.0674	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1073.4949	0.1555	166.9346	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1913.6195	0.1412	270.2448	(264)
Space and water heating			437.1795	(265)
Pumps, fans and electric keep-hot	154.4950	0.1387	21.4304	(267)
Energy for lighting	93.3118	0.1443	13.4678	(268)
Energy saving/generation technologies				

PV Unit electricity used in dwelling	-267.0854	0.1320	-35.2678	
PV Unit electricity exported	-114.2873	0.1212	-13.8554	
Total			-49.1232	(269)
Total CO2, kg/year			422.9544	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1073.4949	1.5757	1691.5461	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1913.6195	1.5222	2912.9178	(278)
Space and water heating			4604.4639	(279)
Pumps, fans and electric keep-hot	154.4950	1.5128	233.7201	(281)
Energy for lighting	93.3118	1.5338	143.1247	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-267.0854	1.4879	-397.3944	
PV Unit electricity exported	-114.2873	0.4448	-50.8345	
Total			-448.2290	(283)
Total Primary energy kWh/year			4533.0797	(286)

Predicted Energy Assessment

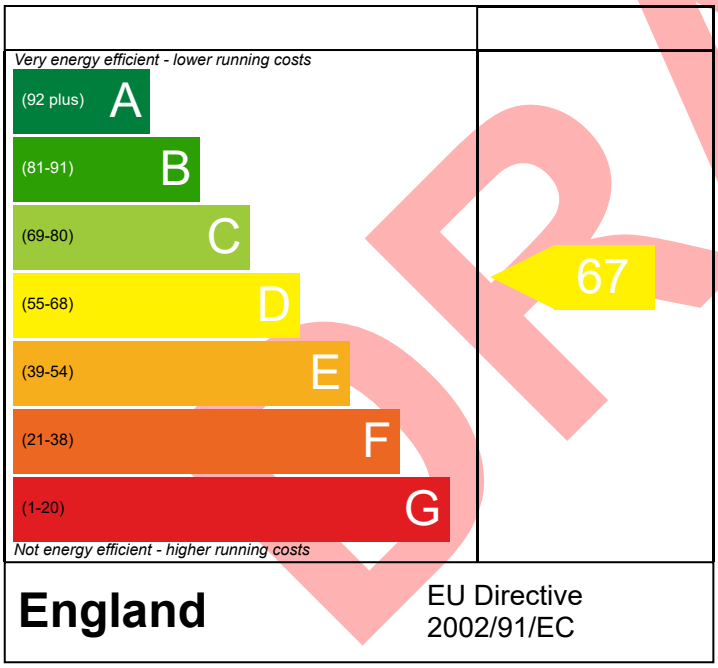
elmhurst energy

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	35.93 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

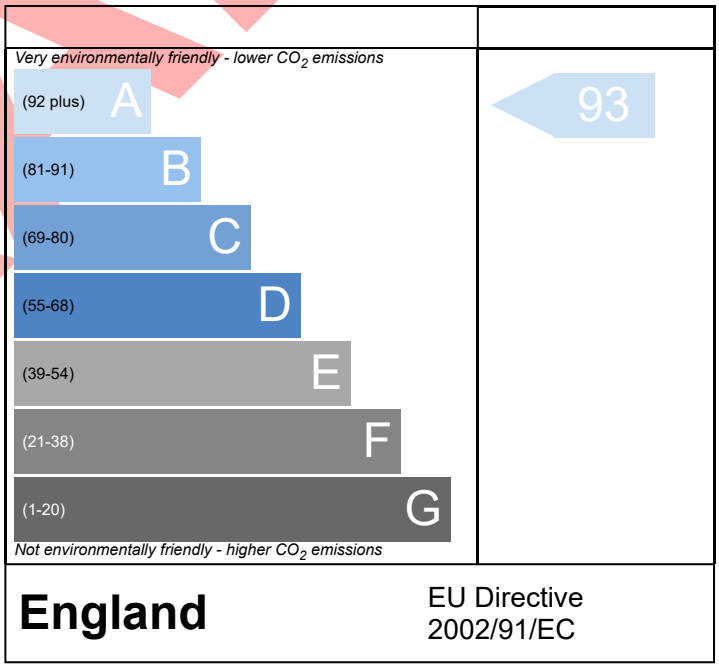
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:33

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	36 m^2
Site Reference	Unit 183 MEZ_Copy	Plot Reference	Unit 183 MEZ_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*21.86 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	10.19 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*118.81 kWh_{PE}/m^2*	
Dwelling primary energy	109.97 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*55.5 kWh/m^2*	
Dwelling fabric energy efficiency	51.2 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.12	Heatloss Floor 1 (0.12)	OK
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	23.79	0.14 **(!)**
Party wall: Party Wall (1)	68.47	0 **(!)**
Party wall: Party Wall (2)	27.42	0 **(!)**
Ground floor: Heatloss Floor 1, Heatloss Floor 1	35.93	0.12

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	5.69	North East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E3: Sill	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.16	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.08	
Party wall	P2: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.46 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 183 MEZ_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 183 MEZ_Copy	**Prop Type Ref**	Unit 183 MEZ
Property			

SAP Rating	71 C	**DER**	10.19	**TER**	21.86
Environmental	94 A	**% DER < TER**			53.39
CO_2 Emissions (t/year)	0.37	**DFEE**	51.17	**TFEE**	55.51
Compliance Check	See BREL	**% DFEE < TFEE**			7.82
% DPER < TPER	7.44	**DPER**	109.97	**TPER**	118.81

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		35.9300 (1b)	x	4.7500 (2b)	=	170.6675	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	35.9300						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.6675	(5)

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2. Ventilation rate

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			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		0 * 10 =	0.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		0.0000 / (5) =	0.0000	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			3.0000	(17)
Infiltration rate			0.1500	(18)
Number of sides sheltered			3	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			5.6900	1.2357	7.0314			(27)
Heatloss Floor 1			35.9300	0.1200	4.3116	75.0000	2694.7500	(28a)
External Wall 1	29.4800	5.6900	23.7900	0.1400	3.3306	14.0000	333.0600	(29a)
Total net area of external elements Aum(A, m2)			65.4100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	14.6736			(33)
Party Wall 1			68.4700	0.0000	0.0000	20.0000	1369.4000	(32)
Wall to corridor			27.4200	0.0000	0.0000	20.0000	548.4000	(32)
Party Ceiling 1			35.9300			80.0000	2874.4000	(32b)
Internal Wall 1			103.4900			9.0000	931.4100	(32c)
Internal Floor 1			21.1000			0.0000	0.0000	(32d)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 8751.4200	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	243.5686	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	2.4400	0.0500	0.1220	
E3 Sill	2.4400	0.0500	0.1220	
E4 Jamb	9.3000	0.0500	0.4650	
E5 Ground floor (normal)	5.7200	0.1600	0.9152	
E18 Party wall between dwellings	10.3000	0.0600	0.6180	
P1 Party wall - Ground floor	18.6200	0.0800	1.4896	
P2 Party wall - Intermediate floor within a dwelling	13.2400	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.7318 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 18.4054 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.2326	16.0689	15.9052	15.0868	14.9231	14.1047	14.1047	13.9410	14.4321	14.9231	15.2505	15.5778	(38)
Heat transfer coeff	34.6379	34.4742	34.3106	33.4922	33.3285	32.5101	32.5101	32.3464	32.8374	33.3285	33.6558	33.9832	(39)
Average = Sum(39)m / 12 =												33.4512	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9640	0.9595	0.9549	0.9322	0.9276	0.9048	0.9048	0.9003	0.9139	0.9276	0.9367	0.9458	(40)
HLP (average)												0.9310	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.3029 (42)
Hot water usage for mixer showers

81.2374	80.0165	78.2375	74.8337	72.3218	69.5205	67.9283	69.6938	71.6292	74.6369	78.1138	80.9261	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

27.9726	26.9554	25.9383	24.9211	23.9039	22.8867	22.8867	23.9039	24.9211	25.9383	26.9554	27.9726	(42c)

Average daily hot water use (litres/day) 100.3278 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.2100	106.9720	104.1758	99.7548	96.2257	92.4072	90.8150	93.5977	96.5503	100.5752	105.0693	108.8987	(44)
Energy conte	172.9619	152.3267	160.1143	136.5593	129.5383	113.6255	109.8329	115.8935	119.0561	136.4795	149.6904	170.5091	(45)
Energy content (annual)										Total = Sum(45)m =		1666.5875	
Distribution loss (46)m = 0.15 x (45)m	25.9443	22.8490	24.0171	20.4839	19.4307	17.0438	16.4749	17.3840	17.8584	20.4719	22.4536	25.5764	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(64)

Total per year (kWh/year) = Sum(64)m = 1913.6195 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

74.2945	65.8089	70.0226	61.6492	59.8561	54.0237	53.3041	55.3192	55.8294	62.1641	66.0153	73.4789	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.2890	11.8032	9.5990	7.2670	5.4322	4.5861	4.9554	6.4413	8.6455	10.9774	12.8122	13.6583	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	166.3438	168.0699	163.7201	154.4599	142.7706	131.7843	124.4448	122.7187	127.0684	136.3286	148.0179	159.0042	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	(71)
Water heating gains (Table 5)	99.8582	97.9300	94.1165	85.6239	80.4518	75.0329	71.6452	74.3538	77.5408	83.5539	91.6879	98.7620	(72)
Total internal gains	349.6683	347.9804	337.6129	317.5282	298.8319	281.5806	271.2228	273.6911	283.4320	301.0372	322.6954	341.6019	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.6900	11.2829	0.6300	0.8270	0.7700	23.1800	(75)

Solar gains	23.1800	47.1836	85.0099	139.6106	187.6641	200.0697	187.1611	149.2070	103.5858	57.6621	29.1665	18.9300	(83)
Total gains	372.8483	395.1640	422.6227	457.1388	486.4960	481.6503	458.3839	422.8981	387.0178	358.6993	351.8618	360.5319	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.1817	70.5150	70.8514	72.5827	72.9391	74.7753	74.7753	75.1537	74.0298	72.9391	72.2297	71.5339	
alpha	5.6788	5.7010	5.7234	5.8388	5.8626	5.9850	5.9850	6.0102	5.9353	5.8626	5.8153	5.7689	
util living area	0.9690	0.9537	0.9112	0.7978	0.6199	0.4304	0.3119	0.3514	0.5751	0.8392	0.9448	0.9728	(86)
MIT	20.3150	20.4375	20.6447	20.8713	20.9734	20.9975	20.9997	20.9994	20.9872	20.8552	20.5707	20.3030	(87)
Th 2	20.1134	20.1172	20.1211	20.1403	20.1441	20.1634	20.1634	20.1673	20.1557	20.1441	20.1364	20.1287	(88)
util rest of house	0.9611	0.9423	0.8905	0.7599	0.5684	0.3748	0.2527	0.2880	0.5090	0.7984	0.9294	0.9658	(89)
MIT 2	19.3467	19.5005	19.7521	20.0218	20.1241	20.1621	20.1633	20.1671	20.1480	20.0149	19.6818	19.3443	(90)
Living area fraction										fLA = Living area / (4) =		0.7762	(91)
MIT	20.0983	20.2278	20.4450	20.6812	20.7833	20.8106	20.8125	20.8132	20.7994	20.6672	20.3718	20.0884	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0983	20.2278	20.4450	20.6812	20.7833	20.8106	20.8125	20.8132	20.7994	20.6672	20.3718	20.0884	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9609	0.9439	0.8986	0.7843	0.6071	0.4179	0.2986	0.3372	0.5597	0.8243	0.9340	0.9654	(94)
Useful gains	358.2789	372.9885	379.7787	358.5390	295.3628	201.2600	136.8807	142.6117	216.6028	295.6678	328.6452	348.0657	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	547.2203	528.4153	478.4604	394.5773	302.7336	201.9061	136.9502	142.7501	219.9921	335.5233	446.6727	539.9401	(97)
Space heating kWh	140.5724	104.4468	73.4192	25.9476	5.4838	0.0000	0.0000	0.0000	0.0000	29.6525	84.9798	142.7546	(98a)
Space heating requirement - total per year (kWh/year)												607.2567	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	140.5724	104.4468	73.4192	25.9476	5.4838	0.0000	0.0000	0.0000	0.0000	29.6525	84.9798	142.7546	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												607.2567	
Space heating per m2										(98c) / (4) =		16.9011	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	140.5724	104.4468	73.4192	25.9476	5.4838	0.0000	0.0000	0.0000	0.0000	29.6525	84.9798	142.7546	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	140.5724	104.4468	73.4192	25.9476	5.4838	0.0000	0.0000	0.0000	0.0000	29.6525	84.9798	142.7546	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.1215	11.8517	13.1215	12.6982	13.1215	12.6982	13.1215	13.1215	12.6982	13.1215	12.6982	13.1215	(231)
Lighting	11.6318	9.3314	8.4019	6.1556	4.7548	3.8847	4.3375	5.6380	7.3232	9.6084	10.8527	11.9551	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-8.8103	-14.2164	-23.3362	-29.4308	-34.5313	-33.2468	-32.7381	-29.3867	-23.7830	-17.3260	-10.2045	-7.4027	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.3284	-3.1645	-7.2932	-12.7840	-18.3926	-19.0419	-18.7557	-15.1361	-10.3078	-5.1920	-1.9175	-1.0143	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												607.2567	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												1913.6195	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)													
mechanical ventilation fans (SFP = 0.7420)												154.4950	(230a)
Total electricity for the above, kWh/year												154.4950	(231)
Electricity for lighting (calculated in Appendix L)												93.8751	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-378.7407	(233)
Wind generation												0.0000	(234)

Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2390.5057	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	607.2567	16.4900	100.1366	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1913.6195	16.4900	315.5559	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	154.4950	16.4900	25.4762	(249)
Energy for lighting	93.8751	16.4900	15.4800	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-264.4128	16.4900	-43.6017	
PV Unit electricity exported	-114.3279	5.5900	-6.3909	
Total			-49.9926	(252)
Total energy cost			406.6561	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.8089	(257)
SAP value		70.6773	
SAP rating (Section 12)		71	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	607.2567	0.1571	95.4260	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1913.6195	0.1412	270.2448	(264)
Space and water heating			365.6708	(265)
Pumps, fans and electric keep-hot	154.4950	0.1387	21.4304	(267)
Energy for lighting	93.8751	0.1443	13.5491	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-264.4128	0.1322	-34.9681	
PV Unit electricity exported	-114.3279	0.1224	-13.9924	
Total			-48.9605	(269)
Total CO2, kg/year			351.6898	(272)
CO2 emissions per m2			9.7900	(273)
EI value			94.1769	
EI rating			94	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	35.9300 (1b)	x	4.7500 (2b)	=	170.6675	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	35.9300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.6675	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			5.6900	1.2357	7.0314			(27)
Heatloss Floor 1			35.9300	0.1200	4.3116	75.0000	2694.7500	(28a)
External Wall 1	29.4800	5.6900	23.7900	0.1400	3.3306	14.0000	333.0600	(29a)
Total net area of external elements Aum(A, m2)			65.4100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.6736			(33)
Party Wall 1			68.4700	0.0000	0.0000	20.0000	1369.4000	(32)
Wall to corridor			27.4200	0.0000	0.0000	20.0000	548.4000	(32)
Party Ceiling 1			35.9300			80.0000	2874.4000	(32b)
Internal Wall 1			103.4900			9.0000	931.4100	(32c)
Internal Floor 1			21.1000			0.0000	0.0000	(32d)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 8751.4200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 243.5686 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.4400	0.0500	0.1220
E3 Sill	2.4400	0.0500	0.1220
E4 Jamb	9.3000	0.0500	0.4650
E5 Ground floor (normal)	5.7200	0.1600	0.9152
E18 Party wall between dwellings	10.3000	0.0600	0.6180
P1 Party wall - Ground floor	18.6200	0.0800	1.4896
P2 Party wall - Intermediate floor within a dwelling	13.2400	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.7318 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 18.4054 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3962	16.3962	16.0689	15.0868	14.9231	14.2684	13.9410	13.9410	14.5958	15.4142	15.7415	15.5778	(38)
Heat transfer coeff	34.8016	34.8016	34.4742	33.4922	33.3285	32.6738	32.3464	32.3464	33.0011	33.8195	34.1469	33.9832	(39)
Average = Sum(39)m / 12 =												33.6013	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9686	0.9686	0.9595	0.9322	0.9276	0.9094	0.9003	0.9003	0.9185	0.9413	0.9504	0.9458	(40)
HLP (average)												0.9352	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.3029 (42)
Hot water usage for mixer showers

81.2374	80.0165	78.2375	74.8337	72.3218	69.5205	67.9283	69.6938	71.6292	74.6369	78.1138	80.9261	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

27.9726	26.9554	25.9383	24.9211	23.9039	22.8867	22.8867	23.9039	24.9211	25.9383	26.9554	27.9726	(42c)

Average daily hot water use (litres/day) 100.3278 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.2100	106.9720	104.1758	99.7548	96.2257	92.4072	90.8150	93.5977	96.5503	100.5752	105.0693	108.8987	(44)
Energy conte	172.9619	152.3267	160.1143	136.5593	129.5383	113.6255	109.8329	115.8935	119.0561	136.4795	149.6904	170.5091	(45)
Energy content (annual)										Total = Sum(45)m =		1666.5875	
Distribution loss (46)m = 0.15 x (45)m	25.9443	22.8490	24.0171	20.4839	19.4307	17.0438	16.4749	17.3840	17.8584	20.4719	22.4536	25.5764	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(64)

Total per year (kWh/year) = Sum(64)m = 1913.6195 (64)
Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month

74.2945	65.8089	70.0226	61.6492	59.8561	54.0237	53.3041	55.3192	55.8294	62.1641	66.0153	73.4789	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	13.2890	11.8032	9.5990	7.2670	5.4322	4.5861	4.9554	6.4413	8.6455	10.9774	12.8122	13.6583	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	166.3438	168.0699	163.7201	154.4599	142.7706	131.7843	124.4448	122.7187	127.0684	136.3286	148.0179	159.0042	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	(71)

Water heating gains (Table 5)

	99.8582	97.9300	94.1165	85.6239	80.4518	75.0329	71.6452	74.3538	77.5408	83.5539	91.6879	98.7620	(72)

Total internal gains

	349.6683	347.9804	337.6129	317.5282	298.8319	281.5806	271.2228	273.6911	283.4320	301.0372	322.6954	341.6019	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.6900	10.0309	0.6300	0.8270	0.7700	20.6078	(75)

Solar gains	20.6078	44.6153	83.8589	145.3011	194.3041	201.8896	190.9713	147.3724	101.3317	54.1341	26.6175	17.2319	(83)
Total gains	370.2761	392.5957	421.4717	462.8292	493.1360	483.4702	462.1941	421.0634	384.7637	355.1713	349.3129	358.8338	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	69.8517	69.8517	70.5150	72.5827	72.9391	74.4007	75.1537	75.1537	73.6627	71.8801	71.1910	71.5339	
alpha	5.6568	5.6568	5.7010	5.8388	5.8626	5.9600	6.0102	6.0102	5.9108	5.7920	5.7461	5.7689	
util living area	0.9731	0.9619	0.9298	0.8300	0.6685	0.5216	0.4254	0.4734	0.6747	0.8821	0.9549	0.9766	(86)
MIT	20.2600	20.3585	20.5610	20.8267	20.9568	20.9914	20.9978	20.9961	20.9650	20.7818	20.4998	20.2482	(87)
Th 2	20.1096	20.1096	20.1172	20.1403	20.1441	20.1595	20.1673	20.1673	20.1518	20.1326	20.1249	20.1287	(88)
util rest of house	0.9662	0.9525	0.9133	0.7974	0.6209	0.4675	0.3680	0.4111	0.6146	0.8499	0.9423	0.9706	(89)
MIT 2	19.2750	19.3968	19.6491	19.9736	20.1091	20.1540	20.1662	20.1652	20.1268	19.9254	19.5864	19.2757	(90)
Living area fraction									fLA = Living area / (4) =			0.7762	(91)
MIT	20.0396	20.1433	20.3570	20.6358	20.7671	20.8041	20.8117	20.8102	20.7775	20.5902	20.2954	20.0306	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0396	20.1433	20.3570	20.6358	20.7671	20.8041	20.8117	20.8102	20.7775	20.5902	20.2954	20.0306	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9656	0.9529	0.9181	0.8168	0.6559	0.5091	0.4125	0.4593	0.6595	0.8678	0.9450	0.9699	(94)
Useful gains	357.5321	374.1143	386.9640	378.0229	323.4453	246.1462	190.6649	193.3972	253.7501	308.2132	330.0957	348.0194	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	561.6824	551.3727	508.7355	426.5507	335.5208	248.4530	191.2232	194.4074	263.2649	368.3005	467.6551	554.9667	(97)
Space heating kWh	151.8878	119.1176	90.5980	34.9400	8.9842	0.0000	0.0000	0.0000	0.0000	44.7049	99.0428	153.9688	(98a)
Space heating requirement - total per year (kWh/year)												703.2442	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	151.8878	119.1176	90.5980	34.9400	8.9842	0.0000	0.0000	0.0000	0.0000	44.7049	99.0428	153.9688	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												703.2442	
Space heating per m2											(98c) / (4) =	19.5726	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	151.8878	119.1176	90.5980	34.9400	8.9842	0.0000	0.0000	0.0000	0.0000	44.7049	99.0428	153.9688	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	151.8878	119.1176	90.5980	34.9400	8.9842	0.0000	0.0000	0.0000	0.0000	44.7049	99.0428	153.9688	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(64)
Efficiency of water heater												100.0000	(216)

(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.1215	11.8517	13.1215	12.6982	13.1215	12.6982	13.1215	13.1215	12.6982	13.1215	12.6982	13.1215	(231)
Lighting	11.6318	9.3314	8.4019	6.1556	4.7548	3.8847	4.3375	5.6380	7.3232	9.6084	10.8527	11.9551	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-7.9690	-13.6985	-23.4605	-30.8905	-35.9002	-33.7534	-33.5336	-29.3960	-23.6207	-16.6713	-9.4910	-6.8348	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.1179	-2.9163	-7.1583	-13.6335	-19.5439	-19.5759	-19.5982	-15.1448	-10.1853	-4.7250	-1.6712	-0.8825	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	703.2442	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	1913.6195	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	154.4950	(230a)
Total electricity for the above, kWh/year	154.4950	(231)
Electricity for lighting (calculated in Appendix L)	93.8751	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-381.3727	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2483.8612	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	703.2442	25.1600	176.9362	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1913.6195	25.1600	481.4667	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	154.4950	25.1600	38.8710	(249)
Energy for lighting	93.8751	25.1600	23.6190	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-265.2196	25.1600	-66.7293	
PV Unit electricity exported	-116.1530	5.8100	-6.7485	
Total			-73.4778	(252)
Total energy cost			647.4151	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	703.2442	0.1564	109.9926	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1913.6195	0.1412	270.2448	(264)
Space and water heating			380.2375	(265)
Pumps, fans and electric keep-hot	154.4950	0.1387	21.4304	(267)
Energy for lighting	93.8751	0.1443	13.5491	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-265.2196	0.1320	-34.9976	
PV Unit electricity exported	-116.1530	0.1218	-14.1483	
Total			-49.1459	(269)
Total CO2, kg/year			366.0710	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	703.2442	1.5791	1110.4649	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1913.6195	1.5222	2912.9178	(278)
Space and water heating			4023.3827	(279)
Pumps, fans and electric keep-hot	154.4950	1.5128	233.7201	(281)
Energy for lighting	93.8751	1.5338	143.9888	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-265.2196	1.4876	-394.5280	
PV Unit electricity exported	-116.1530	0.4470	-51.9162	
Total			-446.4442	(283)
Total Primary energy kWh/year			3954.6474	(286)

SAP 10 EPC IMPROVEMENTS

Unit 183 MEZ_Copy

Current energy efficiency rating: C 71
Current environmental impact rating: A 94

N Solar water heating	Not applicable
U Solar photovoltaic panels	Not applicable
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 71
Potential environmental impact rating: A 94

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£721	£721	£0
Space heating	£216	£216	£0
Water heating	£481	£481	£0
Lighting	£24	£24	£0
Generated (PV)	-£73	-£73	£0
Total cost of fuels	£648	£648	£0
Total cost of uses	£648	£648	£0
Delivered energy	69 kWh/m²	69 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	10 kg/m²	10 kg/m²	0 kg/m²
Primary energy	110 kWh/m²	110 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	35.9300	(1b)	x 4.7500	(2b) =	170.6675	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	35.9300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		170.6675	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			5.6900	1.2357	7.0314			(27)
Heatloss Floor 1			35.9300	0.1200	4.3116	75.0000	2694.7500	(28a)
External Wall 1	29.4800	5.6900	23.7900	0.1400	3.3306	14.0000	333.0600	(29a)
Total net area of external elements Aum(A, m2)			65.4100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	14.6736			(33)
Party Wall 1			68.4700	0.0000	0.0000	20.0000	1369.4000	(32)
Wall to corridor			27.4200	0.0000	0.0000	20.0000	548.4000	(32)
Party Ceiling 1			35.9300			80.0000	2874.4000	(32b)
Internal Wall 1			103.4900			9.0000	931.4100	(32c)
Internal Floor 1			21.1000			0.0000	0.0000	(32d)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 8751.4200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 243.5686 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.4400	0.0500	0.1220
E3 Sill	2.4400	0.0500	0.1220
E4 Jamb	9.3000	0.0500	0.4650
E5 Ground floor (normal)	5.7200	0.1600	0.9152
E18 Party wall between dwellings	10.3000	0.0600	0.6180
P1 Party wall - Ground floor	18.6200	0.0800	1.4896
P2 Party wall - Intermediate floor within a dwelling	13.2400	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.7318 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 18.4054 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.2326	16.0689	15.9052	15.0868	14.9231	14.1047	14.1047	13.9410	14.4321	14.9231	15.2505	15.5778	(38)
Heat transfer coeff	34.6379	34.4742	34.3106	33.4922	33.3285	32.5101	32.5101	32.3464	32.8374	33.3285	33.6558	33.9832	(39)

Average = Sum(39)m / 12 = 33.4512

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9640	0.9595	0.9549	0.9322	0.9276	0.9048	0.9048	0.9003	0.9139	0.9276	0.9367	0.9458	(40)
HLP (average)												0.9310	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.3029 (42)
Hot water usage for mixer showers

	81.2374	80.0165	78.2375	74.8337	72.3218	69.5205	67.9283	69.6938	71.6292	74.6369	78.1138	80.9261	(42a)

Hot water usage for baths

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

	27.9726	26.9554	25.9383	24.9211	23.9039	22.8867	22.8867	23.9039	24.9211	25.9383	26.9554	27.9726	(42c)

Average daily hot water use (litres/day) 100.3278 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.2100	106.9720	104.1758	99.7548	96.2257	92.4072	90.8150	93.5977	96.5503	100.5752	105.0693	108.8987	(44)
Energy conte	172.9619	152.3267	160.1143	136.5593	129.5383	113.6255	109.8329	115.8935	119.0561	136.4795	149.6904	170.5091	(45)
Energy content (annual)										Total = Sum(45)m =		1666.5875	
Distribution loss (46)m = 0.15 x (45)m	25.9443	22.8490	24.0171	20.4839	19.4307	17.0438	16.4749	17.3840	17.8584	20.4719	22.4536	25.5764	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(64)
										Total per year (kWh/year) = Sum(64)m =		1913.6195	(64)

Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

	74.2945	65.8089	70.0226	61.6492	59.8561	54.0237	53.3041	55.3192	55.8294	62.1641	66.0153	73.4789	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.2890	11.8032	9.5990	7.2670	5.4322	4.5861	4.9554	6.4413	8.6455	10.9774	12.8122	13.6583	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	166.3438	168.0699	163.7201	154.4599	142.7706	131.7843	124.4448	122.7187	127.0684	136.3286	148.0179	159.0042	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	(71)

Water heating gains (Table 5)
99.8582 97.9300 94.1165 85.6239 80.4518 75.0329 71.6452 74.3538 77.5408 83.5539 91.6879 98.7620 (72)
Total internal gains
349.6683 347.9804 337.6129 317.5282 298.8319 281.5806 271.2228 273.6911 283.4320 301.0372 322.6954 341.6019 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.6900	11.2829	0.6300	0.8270	0.7700	23.1800	(75)

Solar gains	23.1800	47.1836	85.0099	139.6106	187.6641	200.0697	187.1611	149.2070	103.5858	57.6621	29.1665	18.9300	(83)
Total gains	372.8483	395.1640	422.6227	457.1388	486.4960	481.6503	458.3839	422.8981	387.0178	358.6993	351.8618	360.5319	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.1817	70.5150	70.8514	72.5827	72.9391	74.7753	74.7753	75.1537	74.0298	72.9391	72.2297	71.5339	
alpha	5.6788	5.7010	5.7234	5.8388	5.8626	5.9850	5.9850	6.0102	5.9353	5.8626	5.8153	5.7689	
util living area	0.9690	0.9537	0.9112	0.7978	0.6199	0.4304	0.3119	0.3514	0.5751	0.8392	0.9448	0.9728	(86)
MIT	20.3150	20.4375	20.6447	20.8713	20.9734	20.9975	20.9997	20.9994	20.9872	20.8552	20.5707	20.3030	(87)
Th 2	20.1134	20.1172	20.1211	20.1403	20.1441	20.1634	20.1634	20.1673	20.1557	20.1441	20.1364	20.1287	(88)
util rest of house	0.9611	0.9423	0.8905	0.7599	0.5684	0.3748	0.2527	0.2880	0.5090	0.7984	0.9294	0.9658	(89)
MIT 2	19.3467	19.5005	19.7521	20.0218	20.1241	20.1621	20.1633	20.1671	20.1480	20.0149	19.6818	19.3443	(90)
Living area fraction									fLA = Living area / (4) =			0.7762	(91)
MIT	20.0983	20.2278	20.4450	20.6812	20.7833	20.8106	20.8125	20.8132	20.7994	20.6672	20.3718	20.0884	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0983	20.2278	20.4450	20.6812	20.7833	20.8106	20.8125	20.8132	20.7994	20.6672	20.3718	20.0884	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9609	0.9439	0.8986	0.7843	0.6071	0.4179	0.2986	0.3372	0.5597	0.8243	0.9340	0.9654	(94)
Useful gains	358.2789	372.9885	379.7787	358.5390	295.3628	201.2600	136.8807	142.6117	216.6028	295.6678	328.6452	348.0657	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	547.2203	528.4153	478.4604	394.5773	302.7336	201.9061	136.9502	142.7501	219.9921	335.5233	446.6727	539.9401	(97)
Space heating kWh	140.5724	104.4468	73.4192	25.9476	5.4838	0.0000	0.0000	0.0000	0.0000	29.6525	84.9798	142.7546	(98a)
Space heating requirement - total per year (kWh/year)												607.2567	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	140.5724	104.4468	73.4192	25.9476	5.4838	0.0000	0.0000	0.0000	0.0000	29.6525	84.9798	142.7546	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												607.2567	
Space heating per m2										(98c) / (4) =		16.9011	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 100.0000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	140.5724	104.4468	73.4192	25.9476	5.4838	0.0000	0.0000	0.0000	0.0000	29.6525	84.9798	142.7546	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	140.5724	104.4468	73.4192	25.9476	5.4838	0.0000	0.0000	0.0000	0.0000	29.6525	84.9798	142.7546	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.1215	11.8517	13.1215	12.6982	13.1215	12.6982	13.1215	13.1215	12.6982	13.1215	12.6982	13.1215	(231)
Lighting	11.6318	9.3314	8.4019	6.1556	4.7548	3.8847	4.3375	5.6380	7.3232	9.6084	10.8527	11.9551	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-8.8103	-14.2164	-23.3362	-29.4308	-34.5313	-33.2468	-32.7381	-29.3867	-23.7830	-17.3260	-10.2045	-7.4027	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													

(233b)m	-1.3284	-3.1645	-7.2932	-12.7840	-18.3926	-19.0419	-18.7557	-15.1361	-10.3078	-5.1920	-1.9175	-1.0143	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	607.2567	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	1913.6195	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	154.4950	(230a)
Total electricity for the above, kWh/year	154.4950	(231)
Electricity for lighting (calculated in Appendix L)	93.8751	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-378.7407	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2390.5057	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	607.2567	16.4900	100.1366	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1913.6195	16.4900	315.5559	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	154.4950	16.4900	25.4762	(249)
Energy for lighting	93.8751	16.4900	15.4800	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-264.4128	16.4900	-43.6017	
PV Unit electricity exported	-114.3279	5.5900	-6.3909	
Total			-49.9926	(252)
Total energy cost			406.6561	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.8089	(257)
SAP value		70.6773	
SAP rating (Section 12)		71	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	607.2567	0.1571	95.4260	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1913.6195	0.1412	270.2448	(264)
Space and water heating			365.6708	(265)
Pumps, fans and electric keep-hot	154.4950	0.1387	21.4304	(267)
Energy for lighting	93.8751	0.1443	13.5491	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-264.4128	0.1322	-34.9681	
PV Unit electricity exported	-114.3279	0.1224	-13.9924	
Total			-48.9605	(269)
Total CO2, kg/year			351.6898	(272)
CO2 emissions per m2			9.7900	(273)
EI value			94.1769	
EI rating			94	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		35.9300 (1b)	x	4.7500 (2b)	=	170.6675	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	35.9300						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.6675	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			5.6900	1.2357	7.0314			(27)
Heatloss Floor 1			35.9300	0.1200	4.3116	75.0000	2694.7500	(28a)
External Wall 1	29.4800	5.6900	23.7900	0.1400	3.3306	14.0000	333.0600	(29a)
Total net area of external elements Aum(A, m2)			65.4100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.6736			(33)
Party Wall 1			68.4700	0.0000	0.0000	20.0000	1369.4000	(32)
Wall to corridor			27.4200	0.0000	0.0000	20.0000	548.4000	(32)
Party Ceiling 1			35.9300			80.0000	2874.4000	(32b)
Internal Wall 1			103.4900			9.0000	931.4100	(32c)
Internal Floor 1			21.1000			0.0000	0.0000	(32d)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	8751.4200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		243.5686 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.4400	0.0500	0.1220
E3 Sill	2.4400	0.0500	0.1220
E4 Jamb	9.3000	0.0500	0.4650
E5 Ground floor (normal)	5.7200	0.1600	0.9152
E18 Party wall between dwellings	10.3000	0.0600	0.6180
P1 Party wall - Ground floor	18.6200	0.0800	1.4896
P2 Party wall - Intermediate floor within a dwelling	13.2400	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.7318 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	18.4054 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3962	16.3962	16.0689	15.0868	14.9231	14.2684	13.9410	13.9410	14.5958	15.4142	15.7415	15.5778	(38)
Heat transfer coeff	34.8016	34.8016	34.4742	33.4922	33.3285	32.6738	32.3464	32.3464	33.0011	33.8195	34.1469	33.9832	(39)
Average = Sum(39)m / 12 =												33.6013	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9686	0.9686	0.9595	0.9322	0.9276	0.9094	0.9003	0.9003	0.9185	0.9413	0.9504	0.9458	(40)
HLP (average)												0.9352	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.3029 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	81.2374	80.0165	78.2375	74.8337	72.3218	69.5205	67.9283	69.6938	71.6292	74.6369	78.1138	80.9261	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	27.9726	26.9554	25.9383	24.9211	23.9039	22.8867	22.8867	23.9039	24.9211	25.9383	26.9554	27.9726	(42c)
Average daily hot water use (litres/day)												100.3278	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.2100	106.9720	104.1758	99.7548	96.2257	92.4072	90.8150	93.5977	96.5503	100.5752	105.0693	108.8987	(44)
Energy conte	172.9619	152.3267	160.1143	136.5593	129.5383	113.6255	109.8329	115.8935	119.0561	136.4795	149.6904	170.5091	(45)
Energy content (annual)										Total = Sum(45)m =		1666.5875	
Distribution loss (46)m = 0.15 x (45)m	25.9443	22.8490	24.0171	20.4839	19.4307	17.0438	16.4749	17.3840	17.8584	20.4719	22.4536	25.5764	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)

Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(64)
									Total per year (kWh/year) = Sum(64)m =			1913.6195	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month													
	74.2945	65.8089	70.0226	61.6492	59.8561	54.0237	53.3041	55.3192	55.8294	62.1641	66.0153	73.4789	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.2890	11.8032	9.5990	7.2670	5.4322	4.5861	4.9554	6.4413	8.6455	10.9774	12.8122	13.6583	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	166.3438	168.0699	163.7201	154.4599	142.7706	131.7843	124.4448	122.7187	127.0684	136.3286	148.0179	159.0042	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	(71)
Water heating gains (Table 5)													
	99.8582	97.9300	94.1165	85.6239	80.4518	75.0329	71.6452	74.3538	77.5408	83.5539	91.6879	98.7620	(72)
Total internal gains													
	349.6683	347.9804	337.6129	317.5282	298.8319	281.5806	271.2228	273.6911	283.4320	301.0372	322.6954	341.6019	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.6900	10.0309	0.6300	0.8270	0.7700	20.6078	(75)

Solar gains	20.6078	44.6153	83.8589	145.3011	194.3041	201.8896	190.9713	147.3724	101.3317	54.1341	26.6175	17.2319	(83)
Total gains	370.2761	392.5957	421.4717	462.8292	493.1360	483.4702	462.1941	421.0634	384.7637	355.1713	349.3129	358.8338	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	69.8517	69.8517	70.5150	72.5827	72.9391	74.4007	75.1537	75.1537	73.6627	71.8801	71.1910	71.5339	
alpha	5.6568	5.6568	5.7010	5.8388	5.8626	5.9600	6.0102	6.0102	5.9108	5.7920	5.7461	5.7689	
util living area													
	0.9731	0.9619	0.9298	0.8300	0.6685	0.5216	0.4254	0.4734	0.6747	0.8821	0.9549	0.9766	(86)
MIT	20.2600	20.3585	20.5610	20.8267	20.9568	20.9914	20.9978	20.9961	20.9650	20.7818	20.4998	20.2482	(87)
Th 2	20.1096	20.1096	20.1172	20.1403	20.1441	20.1595	20.1673	20.1673	20.1518	20.1326	20.1249	20.1287	(88)
util rest of house													
	0.9662	0.9525	0.9133	0.7974	0.6209	0.4675	0.3680	0.4111	0.6146	0.8499	0.9423	0.9706	(89)
MIT 2	19.2750	19.3968	19.6491	19.9736	20.1091	20.1540	20.1662	20.1652	20.1268	19.9254	19.5864	19.2757	(90)
Living area fraction										fLA = Living area / (4) =		0.7762	(91)
MIT	20.0396	20.1433	20.3570	20.6358	20.7671	20.8041	20.8117	20.8102	20.7775	20.5902	20.2954	20.0306	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0396	20.1433	20.3570	20.6358	20.7671	20.8041	20.8117	20.8102	20.7775	20.5902	20.2954	20.0306	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9656	0.9529	0.9181	0.8168	0.6559	0.5091	0.4125	0.4593	0.6595	0.8678	0.9450	0.9699	(94)
Useful gains	357.5321	374.1143	386.9640	378.0229	323.4453	246.1462	190.6649	193.3972	253.7501	308.2132	330.0957	348.0194	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	561.6824	551.3727	508.7355	426.5507	335.5208	248.4530	191.2232	194.4074	263.2649	368.3005	467.6551	554.9667	(97)
Space heating kWh													
	151.8878	119.1176	90.5980	34.9400	8.9842	0.0000	0.0000	0.0000	0.0000	44.7049	99.0428	153.9688	(98a)
Space heating requirement - total per year (kWh/year)												703.2442	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	151.8878	119.1176	90.5980	34.9400	8.9842	0.0000	0.0000	0.0000	0.0000	44.7049	99.0428	153.9688	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												703.2442	
Space heating per m2											(98c) / (4) =	19.5726	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	151.8878	119.1176	90.5980	34.9400	8.9842	0.0000	0.0000	0.0000	0.0000	44.7049	99.0428	153.9688	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	151.8878	119.1176	90.5980	34.9400	8.9842	0.0000	0.0000	0.0000	0.0000	44.7049	99.0428	153.9688	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.1215	11.8517	13.1215	12.6982	13.1215	12.6982	13.1215	13.1215	12.6982	13.1215	12.6982	13.1215	(231)
Lighting	11.6318	9.3314	8.4019	6.1556	4.7548	3.8847	4.3375	5.6380	7.3232	9.6084	10.8527	11.9551	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-7.9690	-13.6985	-23.4605	-30.8905	-35.9002	-33.7534	-33.5336	-29.3960	-23.6207	-16.6713	-9.4910	-6.8348	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.1179	-2.9163	-7.1583	-13.6335	-19.5439	-19.5759	-19.5982	-15.1448	-10.1853	-4.7250	-1.6712	-0.8825	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												703.2442	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												1913.6195	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)													
mechanical ventilation fans (SFP = 0.7420)												154.4950	(230a)
Total electricity for the above, kWh/year												154.4950	(231)
Electricity for lighting (calculated in Appendix L)												93.8751	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-381.3727	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2483.8612	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	703.2442	25.1600	176.9362	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1913.6195	25.1600	481.4667	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	154.4950	25.1600	38.8710	(249)
Energy for lighting	93.8751	25.1600	23.6190	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-265.2196	25.1600	-66.7293	
PV Unit electricity exported	-116.1530	5.8100	-6.7485	
Total			-73.4778	(252)
Total energy cost			647.4151	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	703.2442	0.1564	109.9926	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1913.6195	0.1412	270.2448	(264)
Space and water heating			380.2375	(265)
Pumps, fans and electric keep-hot	154.4950	0.1387	21.4304	(267)
Energy for lighting	93.8751	0.1443	13.5491	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-265.2196	0.1320	-34.9976	
PV Unit electricity exported	-116.1530	0.1218	-14.1483	
Total			-49.1459	(269)
Total CO2, kg/year			366.0710	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	703.2442	1.5791	1110.4649	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1913.6195	1.5222	2912.9178	(278)
Space and water heating			4023.3827	(279)
Pumps, fans and electric keep-hot	154.4950	1.5128	233.7201	(281)
Energy for lighting	93.8751	1.5338	143.9888	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-265.2196	1.4876	-394.5280	
PV Unit electricity exported	-116.1530	0.4470	-51.9162	
Total			-446.4442	(283)
Total Primary energy kWh/year			3954.6474	(286)

Predicted Energy Assessment

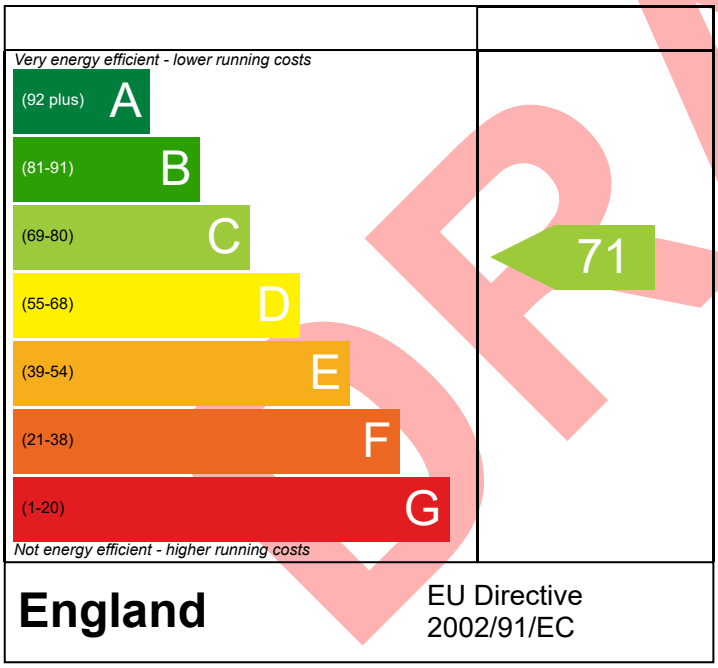
elmhurst energy

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	35.93 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

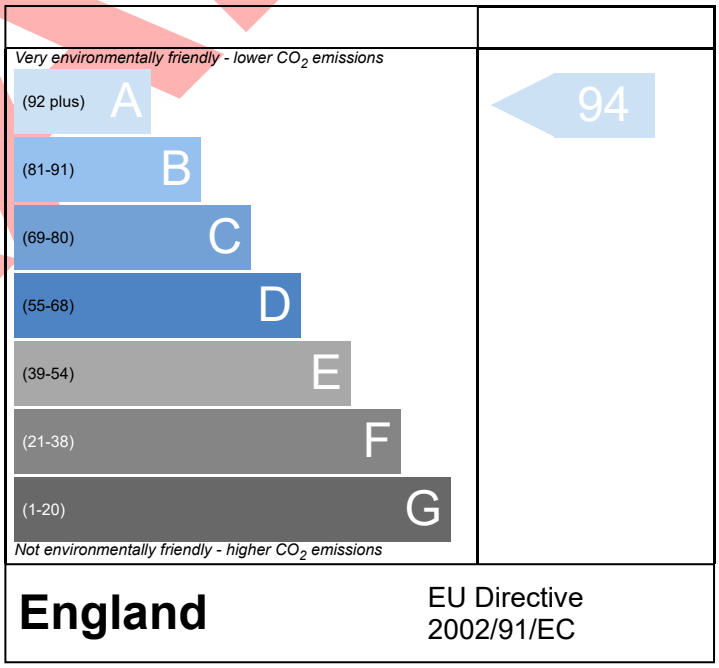
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:33

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	72 m^2
Site Reference	Unit 214 L08_Copy	Plot Reference	Unit 214 L08_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*13.16 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	6.11 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*71.07 kWh_{PE}/m^2*	
Dwelling primary energy	67.27 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*31.1 kWh/m^2*	
Dwelling fabric energy efficiency	29.2 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	14.58	0.14 **(!)**
Party wall: Party Wall (1)	60.42	0 **(!)**
Party wall: Party Wall (2)	16.53	0 **(!)**
Exposed roof: Roof (1)	72.08	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	10.77	South West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E15: Flat roof with parapet	Calculated by person with suitable expertise	0.56	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.12	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.93 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 214 L08_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 214 L08_Copy	**Prop Type Ref**	Unit 214 L08
Property			

SAP Rating	75 C	**DER**	6.11	**TER**	13.16
Environmental	95 A	**% DER < TER**			53.57
CO_2 Emissions (t/year)	0.44	**DFEE**	29.16	**TFEE**	31.12
Compliance Check	See BREL	**% DFEE < TFEE**			6.31
% DPER < TPER	5.35	**DPER**	67.27	**TPER**	71.07

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	72.0800	(1b)	x 3.0000	(2b) =	216.2400	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0800					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		216.2400	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												72.0000	(23c)
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.7700	1.2357	13.3089			(27)
External Wall 1	25.3500	10.7700	14.5800	0.1400	2.0412	14.0000	204.1200	(29a)
External Roof 1	72.0800		72.0800	0.1100	7.9288	9.0000	648.7200	(30)
Total net area of external elements Aum(A, m2)			97.4300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	23.2789			(33)
Party Wall 1			60.4200	0.0000	0.0000	20.0000	1208.4000	(32)
Wall to corridor			16.5300	0.0000	0.0000	20.0000	330.6000	(32)
Party Floor 1			72.0800			80.0000	5766.4000	(32d)
Internal Wall 1			153.9000			9.0000	1385.1000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9543.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		132.3993 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	4.6400	0.0500	0.2320

E4 Jamb	27.8400	0.0500	1.3920	
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915	
E18 Party wall between dwellings	6.0000	0.0600	0.3600	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	28.6500	0.0000	0.0000	
E15 Flat roof with parapet	8.4500	0.5600	4.7320	
P4 Party wall - Roof (insulation at ceiling level)	28.6500	0.1200	3.4380	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				10.7455 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	34.0244 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	20.5671	20.3597	20.1523	19.1153	18.9080	17.8710	17.8710	17.6636	18.2858	18.9080	19.3227	19.7375	(38)
Heat transfer coeff	54.5915	54.3841	54.1767	53.1398	52.9324	51.8955	51.8955	51.6881	52.3102	52.9324	53.3472	53.7619	(39)
Average = Sum(39)m / 12 =												53.0879	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7574	0.7545	0.7516	0.7372	0.7344	0.7200	0.7200	0.7171	0.7257	0.7344	0.7401	0.7459	(40)
HLP (average)												0.7365	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2955	(42)
Hot water usage for mixer showers	86.2240	84.9283	83.0401	79.4273	76.7612	73.7880	72.0980	73.9719	76.0261	79.2184	82.9088	85.8937	(42a)
Hot water usage for baths	27.0899	26.6876	26.1210	25.0764	24.2942	23.4268	22.9583	23.5209	24.1335	25.0616	26.1277	26.9983	(42b)
Hot water usage for other uses	38.1387	36.7518	35.3650	33.9781	32.5912	31.2044	31.2044	32.5912	33.9781	35.3650	36.7518	38.1387	(42c)
Average daily hot water use (litres/day)												139.2838	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.4526	148.3676	144.5260	138.4818	133.6466	128.4192	126.2607	130.0841	134.1377	139.6450	145.7883	151.0307	(44)
Energy conte	239.8639	211.2735	222.1311	189.5747	179.9140	157.9064	152.7014	161.0713	165.4052	189.4969	207.7021	236.4775	(45)
Energy content (annual)										Total = Sum(45)m =		2313.5180	
Distribution loss (46)m = 0.15 x (45)m	35.9796	31.6910	33.3197	28.4362	26.9871	23.6860	22.9052	24.1607	24.8108	28.4245	31.1553	35.4716	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	260.8447	230.2239	243.1119	209.8787	200.8948	178.2104	173.6822	182.0521	185.7092	210.4777	228.0061	257.4583	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	260.8447	230.2239	243.1119	209.8787	200.8948	178.2104	173.6822	182.0521	185.7092	210.4777	228.0061	257.4583	(64)
										Total per year (kWh/year) = Sum(64)m =		2560.5500	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	96.5394	85.4088	90.6432	79.2768	76.6061	68.7471	67.5579	70.3408	71.2404	79.7924	85.3042	95.4134	(65)

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5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.8367	21.1715	17.2179	13.0350	9.7438	8.2262	8.8886	11.5538	15.5075	19.6903	22.9815	24.4992	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.6450	304.7751	296.8873	280.0950	258.8978	238.9754	225.6661	222.5359	230.4238	247.2160	268.4132	288.3356	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	(71)
Water heating gains (Table 5)	129.7572	127.0964	121.8323	110.1066	102.9651	95.4820	90.8036	94.5441	98.9450	107.2478	118.4780	128.2438	(72)
Total internal gains	552.2186	550.0227	532.9171	500.2164	468.5865	439.6633	422.3380	425.6136	441.8560	471.1338	506.8524	538.0583	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	10.7700	36.7938	0.6300	0.8270	0.7700	143.0771	(79)

Solar gains	143.0771	243.7132	333.4590	413.1719	462.7869	459.4403	442.9495	405.9344	361.0656	269.3550	171.3733	122.4442	(83)
Total gains	695.2957	793.7359	866.3761	913.3882	931.3734	899.1036	865.2874	831.5480	802.9215	740.4888	678.2258	660.5025	(84)

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7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	48.5594	48.7445	48.9311	49.8859	50.0814	51.0821	51.0821	51.2870	50.6770	50.0814	49.6920	49.3086	
alpha	4.2373	4.2496	4.2621	4.3257	4.3388	4.4055	4.4055	4.4191	4.3785	4.3388	4.3128	4.2872	
util living area	0.9007	0.8470	0.7683	0.6500	0.5123	0.3665	0.2633	0.2851	0.4420	0.6771	0.8461	0.9132	(86)
MIT	20.2373	20.4563	20.6791	20.8674	20.9594	20.9929	20.9987	20.9982	20.9836	20.8678	20.5495	20.1953	(87)
Th 2	20.2904	20.2929	20.2955	20.3081	20.3106	20.3232	20.3232	20.3258	20.3182	20.3106	20.3055	20.3005	(88)
util rest of house	0.8886	0.8304	0.7459	0.6210	0.4779	0.3287	0.2231	0.2437	0.4005	0.6434	0.8269	0.9023	(89)
MIT 2	19.4157	19.6821	19.9478	20.1734	20.2736	20.3180	20.3225	20.3247	20.3052	20.1807	19.8101	19.3726	(90)
Living area fraction										fLA = Living area / (4) =		0.4075	(91)
MIT	19.7505	19.9976	20.2458	20.4562	20.5530	20.5930	20.5980	20.5991	20.5816	20.4606	20.1114	19.7078	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7505	19.9976	20.2458	20.4562	20.5530	20.5930	20.5980	20.5991	20.5816	20.4606	20.1114	19.7078	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8783	0.8230	0.7442	0.6273	0.4901	0.3438	0.2394	0.2605	0.4166	0.6509	0.8211	0.8919	(94)
Useful gains	610.6468	653.2104	644.7561	573.0073	456.4774	309.1089	207.1880	216.6204	334.5177	481.9958	556.8612	589.1027	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	843.4651	821.0676	744.7017	614.0938	468.6109	311.0088	207.4804	217.0447	339.0562	521.9476	694.1205	833.7285	(97)
Space heating kWh	173.2168	112.8000	74.3595	29.5823	9.0273	0.0000	0.0000	0.0000	0.0000	29.7241	98.8266	182.0016	(98a)
Space heating requirement - total per year (kWh/year)												709.5383	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	173.2168	112.8000	74.3595	29.5823	9.0273	0.0000	0.0000	0.0000	0.0000	29.7241	98.8266	182.0016	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												709.5383	
Space heating per m2											(98c) / (4) =	9.8438	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	173.2168	112.8000	74.3595	29.5823	9.0273	0.0000	0.0000	0.0000	0.0000	29.7241	98.8266	182.0016	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	173.2168	112.8000	74.3595	29.5823	9.0273	0.0000	0.0000	0.0000	0.0000	29.7241	98.8266	182.0016	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	260.8447	230.2239	243.1119	209.8787	200.8948	178.2104	173.6822	182.0521	185.7092	210.4777	228.0061	257.4583	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	260.8447	230.2239	243.1119	209.8787	200.8948	178.2104	173.6822	182.0521	185.7092	210.4777	228.0061	257.4583	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	16.6253	15.0164	16.6253	16.0890	16.6253	16.0890	16.6253	16.6253	16.0890	16.6253	16.0890	16.6253	(231)
Lighting	20.8641	16.7380	15.0707	11.0414	8.5287	6.9680	7.7802	10.1130	13.1358	17.2348	19.4667	21.4440	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-17.3370	-27.5878	-44.7239	-55.9209	-65.1632	-62.3985	-61.4127	-55.4427	-45.3047	-33.3957	-19.9584	-14.6070	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.1609	-7.5518	-17.2006	-29.4264	-41.8351	-43.3154	-42.6944	-34.5709	-23.6181	-12.1299	-4.5490	-2.4100	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	709.5383	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2560.5500	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	195.7491	(230a)
Total electricity for the above, kWh/year	195.7491	(231)
Electricity for lighting (calculated in Appendix L)	168.3854	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-765.7149	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)

Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2868.5078	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	709.5383	16.4900	117.0029	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2560.5500	16.4900	422.2347	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	195.7491	16.4900	32.2790	(249)
Energy for lighting	168.3854	16.4900	27.7667	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-503.2525	16.4900	-82.9863	
PV Unit electricity exported	-262.4624	5.5900	-14.6717	
Total			-97.6580	(252)
Total energy cost			501.6253	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.5424	(257)
SAP value		74.9976	
SAP rating (Section 12)		75	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	709.5383	0.1574	111.7128	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2560.5500	0.1413	361.8103	(264)
Space and water heating			473.5231	(265)
Pumps, fans and electric keep-hot	195.7491	0.1387	27.1528	(267)
Energy for lighting	168.3854	0.1443	24.3032	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-503.2525	0.1325	-66.6588	
PV Unit electricity exported	-262.4624	0.1227	-32.2133	
Total			-98.8721	(269)
Total CO2, kg/year			426.1070	(272)
CO2 emissions per m2			5.9100	(273)
EI value			95.1231	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	72.0800	(1b) x	3.0000	(2b) =	216.2400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		216.2400	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.7700	1.2357	13.3089			(27)
External Wall 1	25.3500	10.7700	14.5800	0.1400	2.0412	14.0000	204.1200	(29a)
External Roof 1	72.0800		72.0800	0.1100	7.9288	9.0000	648.7200	(30)
Total net area of external elements Aum(A, m2)			97.4300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	23.2789			(33)
Party Wall 1			60.4200	0.0000	0.0000	20.0000	1208.4000	(32)
Wall to corridor			16.5300	0.0000	0.0000	20.0000	330.6000	(32)
Party Floor 1			72.0800			80.0000	5766.4000	(32d)
Internal Wall 1			153.9000			9.0000	1385.1000	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9543.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 132.3993 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	4.6400	0.0500	0.2320
E4 Jamb	27.8400	0.0500	1.3920
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18 Party wall between dwellings	6.0000	0.0600	0.3600
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	28.6500	0.0000	0.0000
E15 Flat roof with parapet	8.4500	0.5600	4.7320
P4 Party wall - Roof (insulation at ceiling level)	28.6500	0.1200	3.4380

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.7455 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 34.0244 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	20.7744	20.7744	20.3597	19.1153	18.9080	18.0784	17.6636	17.6636	18.4932	19.5301	19.9449	19.7375	(38)
Heat transfer coeff	54.7989	54.7989	54.3841	53.1398	52.9324	52.1028	51.6881	51.6881	52.5176	53.5546	53.9693	53.7619	(39)
Average = Sum(39)m / 12 =												53.2780	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7603	0.7603	0.7545	0.7372	0.7344	0.7228	0.7171	0.7171	0.7286	0.7430	0.7487	0.7459	(40)
HLP (average)												0.7392	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2955 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	86.2240	84.9283	83.0401	79.4273	76.7612	73.7880	72.0980	73.9719	76.0261	79.2184	82.9088	85.8937	(42a)
Hot water usage for baths	27.0899	26.6876	26.1210	25.0764	24.2942	23.4268	22.9583	23.5209	24.1335	25.0616	26.1277	26.9983	(42b)
Hot water usage for other uses	38.1387	36.7518	35.3650	33.9781	32.5912	31.2044	31.2044	32.5912	33.9781	35.3650	36.7518	38.1387	(42c)
Average daily hot water use (litres/day)												139.2838	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.4526	148.3676	144.5260	138.4818	133.6466	128.4192	126.2607	130.0841	134.1377	139.6450	145.7883	151.0307	(44)
Energy conte	239.8639	211.2735	222.1311	189.5747	179.9140	157.9064	152.7014	161.0713	165.4052	189.4969	207.7021	236.4775	(45)
Energy content (annual)										Total = Sum(45)m =		2313.5180	
Distribution loss (46)m = 0.15 x (45)m	35.9796	31.6910	33.3197	28.4362	26.9871	23.6860	22.9052	24.1607	24.8108	28.4245	31.1553	35.4716	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	260.8447	230.2239	243.1119	209.8787	200.8948	178.2104	173.6822	182.0521	185.7092	210.4777	228.0061	257.4583	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	260.8447	230.2239	243.1119	209.8787	200.8948	178.2104	173.6822	182.0521	185.7092	210.4777	228.0061	257.4583	(64)
									Total per year (kWh/year) = Sum(64)m =			2560.5500	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)

Heat gains from water heating, kWh/month	96.5394	85.4088	90.6432	79.2768	76.6061	68.7471	67.5579	70.3408	71.2404	79.7924	85.3042	95.4134	(65)

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5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.8367	21.1715	17.2179	13.0350	9.7438	8.2262	8.8886	11.5538	15.5075	19.6903	22.9815	24.4992	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	301.6450	304.7751	296.8873	280.0950	258.8978	238.9754	225.6661	222.5359	230.4238	247.2160	268.4132	288.3356	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	(71)
Water heating gains (Table 5)													
	129.7572	127.0964	121.8323	110.1066	102.9651	95.4820	90.8036	94.5441	98.9450	107.2478	118.4780	128.2438	(72)
Total internal gains													
	552.2186	550.0227	532.9171	500.2164	468.5865	439.6633	422.3380	425.6136	441.8560	471.1338	506.8524	538.0583	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	10.7700	33.4622	0.6300	0.8270	0.7700	130.1217	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	130.1217	236.5633	338.2708	440.8830	488.8258	471.6574	460.3741	410.2716	362.9956	259.8861	160.1724	113.8804	(83)
Total gains	682.3403	786.5860	871.1879	941.0994	957.4123	911.3207	882.7121	835.8852	804.8516	731.0199	667.0249	651.9387	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.3756	48.3756	48.7445	49.8859	50.0814	50.8788	51.2870	51.2870	50.4769	49.4996	49.1192	49.3086	
alpha	4.2250	4.2250	4.2496	4.3257	4.3388	4.3919	4.4191	4.4191	4.3651	4.3000	4.2746	4.2872	
util living area													
	0.9121	0.8644	0.7932	0.6743	0.5470	0.4387	0.3548	0.3799	0.5182	0.7279	0.8667	0.9231	(86)
MIT	20.1599	20.3722	20.6083	20.8345	20.9422	20.9822	20.9942	20.9922	20.9635	20.8038	20.4667	20.1195	(87)
Th 2	20.2879	20.2879	20.2929	20.3081	20.3106	20.3207	20.3258	20.3258	20.3156	20.3030	20.2980	20.3005	(88)
util rest of house													
	0.9012	0.8495	0.7730	0.6477	0.5148	0.4024	0.3163	0.3397	0.4790	0.6975	0.8496	0.9134	(89)
MIT 2	19.3183	19.5758	19.8618	20.1360	20.2557	20.3058	20.3216	20.3201	20.2839	20.1033	19.7047	19.2785	(90)
Living area fraction									fLA = Living area / (4) =			0.4075	(91)
MIT	19.6612	19.9003	20.1660	20.4206	20.5354	20.5814	20.5956	20.5939	20.5608	20.3887	20.0152	19.6212	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6612	19.9003	20.1660	20.4206	20.5354	20.5814	20.5956	20.5939	20.5608	20.3887	20.0152	19.6212	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8905	0.8407	0.7692	0.6521	0.5254	0.4164	0.3318	0.3558	0.4932	0.7013	0.8421	0.9028	(94)
Useful gains	607.5968	661.2782	670.0925	613.6908	503.0400	379.5179	292.8599	297.4105	396.9843	512.6984	561.6824	588.5548	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	863.6965	854.8785	792.1567	665.3431	520.6138	384.5945	294.3960	299.4778	407.5794	572.4298	724.0087	855.9521	(97)
Space heating kWh													
	190.5382	130.0994	90.8158	37.1896	13.0749	0.0000	0.0000	0.0000	0.0000	44.4401	116.8749	198.9436	(98a)
Space heating requirement - total per year (kWh/year)												821.9765	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	190.5382	130.0994	90.8158	37.1896	13.0749	0.0000	0.0000	0.0000	0.0000	44.4401	116.8749	198.9436	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												821.9765	
Space heating per m2											(98c) / (4) =	11.4037	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	190.5382	130.0994	90.8158	37.1896	13.0749	0.0000	0.0000	0.0000	0.0000	44.4401	116.8749	198.9436	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	190.5382	130.0994	90.8158	37.1896	13.0749	0.0000	0.0000	0.0000	0.0000	44.4401	116.8749	198.9436	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	260.8447	230.2239	243.1119	209.8787	200.8948	178.2104	173.6822	182.0521	185.7092	210.4777	228.0061	257.4583	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													

	260.8447	230.2239	243.1119	209.8787	200.8948	178.2104	173.6822	182.0521	185.7092	210.4777	228.0061	257.4583	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	16.6253	15.0164	16.6253	16.0890	16.6253	16.0890	16.6253	16.6253	16.0890	16.6253	16.0890	16.6253	(231)
Lighting	20.8641	16.7380	15.0707	11.0414	8.5287	6.9680	7.7802	10.1130	13.1358	17.2348	19.4667	21.4440	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.7111	-26.6089	-44.9156	-58.4970	-67.6150	-63.3018	-62.8291	-55.4595	-45.0069	-32.1362	-18.5922	-13.5054	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.6604	-6.9820	-16.9877	-31.5190	-44.4785	-44.5163	-44.5897	-34.5903	-23.3400	-11.1215	-3.9750	-2.0970	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	821.9765	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2560.5500	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	195.7491	(230a)
Total electricity for the above, kWh/year	195.7491	(231)
Electricity for lighting (calculated in Appendix L)	168.3854	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-771.0360	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2975.6250	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	821.9765	25.1600	206.8093	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2560.5500	25.1600	644.2344	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	195.7491	25.1600	49.2505	(249)
Energy for lighting	168.3854	25.1600	42.3658	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-504.1786	25.1600	-126.8513	
PV Unit electricity exported	-266.8574	5.8100	-15.5044	
Total			-142.3558	(252)
Total energy cost			800.3042	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	821.9765	0.1569	128.9322	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2560.5500	0.1413	361.8103	(264)
Space and water heating			490.7425	(265)
Pumps, fans and electric keep-hot	195.7491	0.1387	27.1528	(267)
Energy for lighting	168.3854	0.1443	24.3032	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-504.1786	0.1322	-66.6325	
PV Unit electricity exported	-266.8574	0.1222	-32.6059	
Total			-99.2385	(269)
Total CO2, kg/year			442.9601	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	821.9765	1.5807	1299.2668	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2560.5500	1.5225	3898.4448	(278)
Space and water heating			5197.7115	(279)
Pumps, fans and electric keep-hot	195.7491	1.5128	296.1292	(281)
Energy for lighting	168.3854	1.5338	258.2751	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-504.1786	1.4883	-750.3769	
PV Unit electricity exported	-266.8574	0.4484	-119.6516	
Total			-870.0285	(283)
Total Primary energy kWh/year			4882.0873	(286)

SAP 10 EPC IMPROVEMENTS

Unit 214 L08_Copy

Current energy efficiency rating: C 75
Current environmental impact rating: A 95

N Solar water heating — Not applicable
U Solar photovoltaic panels — Not applicable
V2 Wind turbine — Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 75
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£943	£943	£0
Space heating	£256	£256	£0
Water heating	£644	£644	£0
Lighting	£42	£42	£0
Generated (PV)	-£142	-£142	£0
Total cost of fuels	£801	£801	£0
Total cost of uses	£800	£800	£0
Delivered energy	41 kWh/m²	41 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	68 kWh/m²	68 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	72.0800 (1b)	x	3.0000 (2b)	=	216.2400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	216.2400	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.7700	1.2357	13.3089			(27)
External Wall 1	25.3500	10.7700	14.5800	0.1400	2.0412	14.0000	204.1200	(29a)
External Roof 1	72.0800		72.0800	0.1100	7.9288	9.0000	648.7200	(30)
Total net area of external elements Aum(A, m2)			97.4300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		23.2789			(33)
Party Wall 1			60.4200	0.0000	0.0000	20.0000	1208.4000	(32)
Wall to corridor			16.5300	0.0000	0.0000	20.0000	330.6000	(32)
Party Floor 1			72.0800			80.0000	5766.4000	(32d)
Internal Wall 1			153.9000			9.0000	1385.1000	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9543.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 132.3993 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	4.6400	0.0500	0.2320
E4 Jamb	27.8400	0.0500	1.3920
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18 Party wall between dwellings	6.0000	0.0600	0.3600
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	28.6500	0.0000	0.0000
E15 Flat roof with parapet	8.4500	0.5600	4.7320
P4 Party wall - Roof (insulation at ceiling level)	28.6500	0.1200	3.4380

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.7455 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 34.0244 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	20.5671	20.3597	20.1523	19.1153	18.9080	17.8710	17.8710	17.6636	18.2858	18.9080	19.3227	19.7375	(38)
Heat transfer coeff	54.5915	54.3841	54.1767	53.1398	52.9324	51.8955	51.8955	51.6881	52.3102	52.9324	53.3472	53.7619	(39)

Average = Sum(39)m / 12 = 53.0879

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7574	0.7545	0.7516	0.7372	0.7344	0.7200	0.7200	0.7171	0.7257	0.7344	0.7401	0.7459	(40)
HLP (average)												0.7365	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2955 (42)
Hot water usage for mixer showers

86.2240	84.9283	83.0401	79.4273	76.7612	73.7880	72.0980	73.9719	76.0261	79.2184	82.9088	85.8937	(42a)

Hot water usage for baths

27.0899	26.6876	26.1210	25.0764	24.2942	23.4268	22.9583	23.5209	24.1335	25.0616	26.1277	26.9983	(42b)

Hot water usage for other uses

38.1387	36.7518	35.3650	33.9781	32.5912	31.2044	31.2044	32.5912	33.9781	35.3650	36.7518	38.1387	(42c)

Average daily hot water use (litres/day) 139.2838 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.4526	148.3676	144.5260	138.4818	133.6466	128.4192	126.2607	130.0841	134.1377	139.6450	145.7883	151.0307	(44)
Energy conte	239.8639	211.2735	222.1311	189.5747	179.9140	157.9064	152.7014	161.0713	165.4052	189.4969	207.7021	236.4775	(45)
Energy content (annual)										Total = Sum(45)m =		2313.5180	
Distribution loss (46)m = 0.15 x (45)m	35.9796	31.6910	33.3197	28.4362	26.9871	23.6860	22.9052	24.1607	24.8108	28.4245	31.1553	35.4716	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	260.8447	230.2239	243.1119	209.8787	200.8948	178.2104	173.6822	182.0521	185.7092	210.4777	228.0061	257.4583	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	260.8447	230.2239	243.1119	209.8787	200.8948	178.2104	173.6822	182.0521	185.7092	210.4777	228.0061	257.4583	(64)
										Total per year (kWh/year) = Sum(64)m =		2560.5500	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	96.5394	85.4088	90.6432	79.2768	76.6061	68.7471	67.5579	70.3408	71.2404	79.7924	85.3042	95.4134	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.8367	21.1715	17.2179	13.0350	9.7438	8.2262	8.8886	11.5538	15.5075	19.6903	22.9815	24.4992	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.6450	304.7751	296.8873	280.0950	258.8978	238.9754	225.6661	222.5359	230.4238	247.2160	268.4132	288.3356	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	(71)
Water heating gains (Table 5)	129.7572	127.0964	121.8323	110.1066	102.9651	95.4820	90.8036	94.5441	98.9450	107.2478	118.4780	128.2438	(72)
Total internal gains													

	552.2186	550.0227	532.9171	500.2164	468.5865	439.6633	422.3380	425.6136	441.8560	471.1338	506.8524	538.0583	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	10.7700	36.7938	0.6300	0.8270	0.7700	143.0771	(79)

Solar gains	143.0771	243.7132	333.4590	413.1719	462.7869	459.4403	442.9495	405.9344	361.0656	269.3550	171.3733	122.4442	(83)
Total gains	695.2957	793.7359	866.3761	913.3882	931.3734	899.1036	865.2874	831.5480	802.9215	740.4888	678.2258	660.5025	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.5594	48.7445	48.9311	49.8859	50.0814	51.0821	51.0821	51.2870	50.6770	50.0814	49.6920	49.3086	
alpha	4.2373	4.2496	4.2621	4.3257	4.3388	4.4055	4.4055	4.4191	4.3785	4.3388	4.3128	4.2872	
util living area													
	0.9007	0.8470	0.7683	0.6500	0.5123	0.3665	0.2633	0.2851	0.4420	0.6771	0.8461	0.9132	(86)
MIT	20.2373	20.4563	20.6791	20.8674	20.9594	20.9929	20.9987	20.9982	20.9836	20.8678	20.5495	20.1953	(87)
Th 2	20.2904	20.2929	20.2955	20.3081	20.3106	20.3232	20.3232	20.3258	20.3182	20.3106	20.3055	20.3005	(88)
util rest of house													
	0.8886	0.8304	0.7459	0.6210	0.4779	0.3287	0.2231	0.2437	0.4005	0.6434	0.8269	0.9023	(89)
MIT 2	19.4157	19.6821	19.9478	20.1734	20.2736	20.3180	20.3225	20.3247	20.3052	20.1807	19.8101	19.3726	(90)
Living area fraction										fLA = Living area / (4) =		0.4075	(91)
MIT	19.7505	19.9976	20.2458	20.4562	20.5530	20.5930	20.5980	20.5991	20.5816	20.4606	20.1114	19.7078	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7505	19.9976	20.2458	20.4562	20.5530	20.5930	20.5980	20.5991	20.5816	20.4606	20.1114	19.7078	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8783	0.8230	0.7442	0.6273	0.4901	0.3438	0.2394	0.2605	0.4166	0.6509	0.8211	0.8919	(94)
Useful gains	610.6468	653.2104	644.7561	573.0073	456.4774	309.1089	207.1880	216.6204	334.5177	481.9958	556.8612	589.1027	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	843.4651	821.0676	744.7017	614.0938	468.6109	311.0088	207.4804	217.0447	339.0562	521.9476	694.1205	833.7285	(97)
Space heating kWh													
	173.2168	112.8000	74.3595	29.5823	9.0273	0.0000	0.0000	0.0000	0.0000	29.7241	98.8266	182.0016	(98a)
Space heating requirement - total per year (kWh/year)												709.5383	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	173.2168	112.8000	74.3595	29.5823	9.0273	0.0000	0.0000	0.0000	0.0000	29.7241	98.8266	182.0016	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												709.5383	
Space heating per m2											(98c) / (4) =	9.8438	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	173.2168	112.8000	74.3595	29.5823	9.0273	0.0000	0.0000	0.0000	0.0000	29.7241	98.8266	182.0016	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	173.2168	112.8000	74.3595	29.5823	9.0273	0.0000	0.0000	0.0000	0.0000	29.7241	98.8266	182.0016	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	260.8447	230.2239	243.1119	209.8787	200.8948	178.2104	173.6822	182.0521	185.7092	210.4777	228.0061	257.4583	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	260.8447	230.2239	243.1119	209.8787	200.8948	178.2104	173.6822	182.0521	185.7092	210.4777	228.0061	257.4583	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	16.6253	15.0164	16.6253	16.0890	16.6253	16.0890	16.6253	16.6253	16.0890	16.6253	16.0890	16.6253	(231)
Lighting	20.8641	16.7380	15.0707	11.0414	8.5287	6.9680	7.7802	10.1130	13.1358	17.2348	19.4667	21.4440	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-17.3370	-27.5878	-44.7239	-55.9209	-65.1632	-62.3985	-61.4127	-55.4427	-45.3047	-33.3957	-19.9584	-14.6070	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.1609	-7.5518	-17.2006	-29.4264	-41.8351	-43.3154	-42.6944	-34.5709	-23.6181	-12.1299	-4.5490	-2.4100	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	709.5383	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2560.5500	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	195.7491	(230a)
Total electricity for the above, kWh/year	195.7491	(231)
Electricity for lighting (calculated in Appendix L)	168.3854	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-765.7149	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2868.5078	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	709.5383	16.4900	117.0029	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2560.5500	16.4900	422.2347	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	195.7491	16.4900	32.2790	(249)
Energy for lighting	168.3854	16.4900	27.7667	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-503.2525	16.4900	-82.9863	
PV Unit electricity exported	-262.4624	5.5900	-14.6717	
Total			-97.6580	(252)
Total energy cost			501.6253	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.5424	(257)
SAP value	74.9976	
SAP rating (Section 12)	75	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	709.5383	0.1574	111.7128	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2560.5500	0.1413	361.8103	(264)
Space and water heating			473.5231	(265)
Pumps, fans and electric keep-hot	195.7491	0.1387	27.1528	(267)
Energy for lighting	168.3854	0.1443	24.3032	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-503.2525	0.1325	-66.6588	
PV Unit electricity exported	-262.4624	0.1227	-32.2133	
Total			-98.8721	(269)
Total CO2, kg/year			426.1070	(272)
CO2 emissions per m2			5.9100	(273)
EI value			95.1231	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		72.0800 (1b)	x	3.0000 (2b)	=	216.2400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		216.2400	(5)

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2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery		
If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.7700	1.2357	13.3089			(27)
External Wall 1	25.3500	10.7700	14.5800	0.1400	2.0412	14.0000	204.1200	(29a)
External Roof 1	72.0800		72.0800	0.1100	7.9288	9.0000	648.7200	(30)
Total net area of external elements Aum(A, m2)			97.4300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	23.2789			(33)
Party Wall 1			60.4200	0.0000	0.0000	20.0000	1208.4000	(32)
Wall to corridor			16.5300	0.0000	0.0000	20.0000	330.6000	(32)
Party Floor 1			72.0800			80.0000	5766.4000	(32d)
Internal Wall 1			153.9000			9.0000	1385.1000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9543.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		132.3993 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	4.6400	0.0500	0.2320
E4 Jamb	27.8400	0.0500	1.3920
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18 Party wall between dwellings	6.0000	0.0600	0.3600
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	28.6500	0.0000	0.0000
E15 Flat roof with parapet	8.4500	0.5600	4.7320
P4 Party wall - Roof (insulation at ceiling level)	28.6500	0.1200	3.4380

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.7455 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	34.0244 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	20.7744	20.7744	20.3597	19.1153	18.9080	18.0784	17.6636	17.6636	18.4932	19.5301	19.9449	19.7375	(38)
Heat transfer coeff	54.7989	54.7989	54.3841	53.1398	52.9324	52.1028	51.6881	51.6881	52.5176	53.5546	53.9693	53.7619	(39)
Average = Sum(39)m / 12 =												53.2780	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7603	0.7603	0.7545	0.7372	0.7344	0.7228	0.7171	0.7171	0.7286	0.7430	0.7487	0.7459	(40)
HLP (average)												0.7392	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2955	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	86.2240	84.9283	83.0401	79.4273	76.7612	73.7880	72.0980	73.9719	76.0261	79.2184	82.9088	85.8937	(42a)
Hot water usage for baths	27.0899	26.6876	26.1210	25.0764	24.2942	23.4268	22.9583	23.5209	24.1335	25.0616	26.1277	26.9983	(42b)
Hot water usage for other uses	38.1387	36.7518	35.3650	33.9781	32.5912	31.2044	31.2044	32.5912	33.9781	35.3650	36.7518	38.1387	(42c)
Average daily hot water use (litres/day)												139.2838	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.4526	148.3676	144.5260	138.4818	133.6466	128.4192	126.2607	130.0841	134.1377	139.6450	145.7883	151.0307	(44)
Energy conte	239.8639	211.2735	222.1311	189.5747	179.9140	157.9064	152.7014	161.0713	165.4052	189.4969	207.7021	236.4775	(45)
Energy content (annual)										Total = Sum(45)m =		2313.5180	
Distribution loss (46)m = 0.15 x (45)m	35.9796	31.6910	33.3197	28.4362	26.9871	23.6860	22.9052	24.1607	24.8108	28.4245	31.1553	35.4716	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	260.8447	230.2239	243.1119	209.8787	200.8948	178.2104	173.6822	182.0521	185.7092	210.4777	228.0061	257.4583	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

	260.8447	230.2239	243.1119	209.8787	200.8948	178.2104	173.6822	182.0521	185.7092	210.4777	228.0061	257.4583	(64)

Total per year (kWh/year) = Sum(64)m = 2560.5500 (64)

Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

	96.5394	85.4088	90.6432	79.2768	76.6061	68.7471	67.5579	70.3408	71.2404	79.7924	85.3042	95.4134	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	137.7327	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	23.8367	21.1715	17.2179	13.0350	9.7438	8.2262	8.8886	11.5538	15.5075	19.6903	22.9815	24.4992	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	301.6450	304.7751	296.8873	280.0950	258.8978	238.9754	225.6661	222.5359	230.4238	247.2160	268.4132	288.3356	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	51.0688	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	-91.8218	(71)

Water heating gains (Table 5)

	129.7572	127.0964	121.8323	110.1066	102.9651	95.4820	90.8036	94.5441	98.9450	107.2478	118.4780	128.2438	(72)

Total internal gains

	552.2186	550.0227	532.9171	500.2164	468.5865	439.6633	422.3380	425.6136	441.8560	471.1338	506.8524	538.0583	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	10.7700	33.4622	0.6300	0.8270	0.7700	130.1217	(79)

Solar gains	130.1217	236.5633	338.2708	440.8830	488.8258	471.6574	460.3741	410.2716	362.9956	259.8861	160.1724	113.8804	(83)
Total gains	682.3403	786.5860	871.1879	941.0994	957.4123	911.3207	882.7121	835.8852	804.8516	731.0199	667.0249	651.9387	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.3756	48.3756	48.7445	49.8859	50.0814	50.8788	51.2870	51.2870	50.4769	49.4996	49.1192	49.3086	
alpha	4.2250	4.2250	4.2496	4.3257	4.3388	4.3919	4.4191	4.4191	4.3651	4.3000	4.2746	4.2872	
util living area	0.9121	0.8644	0.7932	0.6743	0.5470	0.4387	0.3548	0.3799	0.5182	0.7279	0.8667	0.9231	(86)
MIT	20.1599	20.3722	20.6083	20.8345	20.9422	20.9822	20.9942	20.9922	20.9635	20.8038	20.4667	20.1195	(87)
Th 2	20.2879	20.2879	20.2929	20.3081	20.3106	20.3207	20.3258	20.3258	20.3156	20.3030	20.2980	20.3005	(88)
util rest of house	0.9012	0.8495	0.7730	0.6477	0.5148	0.4024	0.3163	0.3397	0.4790	0.6975	0.8496	0.9134	(89)
MIT 2	19.3183	19.5758	19.8618	20.1360	20.2557	20.3058	20.3216	20.3201	20.2839	20.1033	19.7047	19.2785	(90)
Living area fraction									fLA = Living area / (4) =			0.4075	(91)
MIT	19.6612	19.9003	20.1660	20.4206	20.5354	20.5814	20.5956	20.5939	20.5608	20.3887	20.0152	19.6212	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6612	19.9003	20.1660	20.4206	20.5354	20.5814	20.5956	20.5939	20.5608	20.3887	20.0152	19.6212	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8905	0.8407	0.7692	0.6521	0.5254	0.4164	0.3318	0.3558	0.4932	0.7013	0.8421	0.9028	(94)
Useful gains	607.5968	661.2782	670.0925	613.6908	503.0400	379.5179	292.8599	297.4105	396.9843	512.6984	561.6824	588.5548	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	863.6965	854.8785	792.1567	665.3431	520.6138	384.5945	294.3960	299.4778	407.5794	572.4298	724.0087	855.9521	(97)
Space heating kWh	190.5382	130.0994	90.8158	37.1896	13.0749	0.0000	0.0000	0.0000	0.0000	44.4401	116.8749	198.9436	(98a)

Space heating requirement - total per year (kWh/year) 821.9765

Solar heating kWh

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)

Solar heating contribution - total per year (kWh/year) 0.0000

Space heating kWh

	190.5382	130.0994	90.8158	37.1896	13.0749	0.0000	0.0000	0.0000	0.0000	44.4401	116.8749	198.9436	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 821.9765

Space heating per m2 (98c) / (4) = 11.4037 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 100.0000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	190.5382	130.0994	90.8158	37.1896	13.0749	0.0000	0.0000	0.0000	0.0000	44.4401	116.8749	198.9436	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	190.5382	130.0994	90.8158	37.1896	13.0749	0.0000	0.0000	0.0000	0.0000	44.4401	116.8749	198.9436	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	260.8447	230.2239	243.1119	209.8787	200.8948	178.2104	173.6822	182.0521	185.7092	210.4777	228.0061	257.4583	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	260.8447	230.2239	243.1119	209.8787	200.8948	178.2104	173.6822	182.0521	185.7092	210.4777	228.0061	257.4583	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	16.6253	15.0164	16.6253	16.0890	16.6253	16.0890	16.6253	16.6253	16.0890	16.6253	16.0890	16.6253	(231)
Lighting	20.8641	16.7380	15.0707	11.0414	8.5287	6.9680	7.7802	10.1130	13.1358	17.2348	19.4667	21.4440	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.7111	-26.6089	-44.9156	-58.4970	-67.6150	-63.3018	-62.8291	-55.4595	-45.0069	-32.1362	-18.5922	-13.5054	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.6604	-6.9820	-16.9877	-31.5190	-44.4785	-44.5163	-44.5897	-34.5903	-23.3400	-11.1215	-3.9750	-2.0970	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1	821.9765	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2560.5500	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	195.7491	(230a)
Total electricity for the above, kWh/year	195.7491	(231)
Electricity for lighting (calculated in Appendix L)	168.3854	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-771.0360	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2975.6250	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	821.9765	25.1600	206.8093	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2560.5500	25.1600	644.2344	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	195.7491	25.1600	49.2505	(249)
Energy for lighting	168.3854	25.1600	42.3658	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-504.1786	25.1600	-126.8513	
PV Unit electricity exported	-266.8574	5.8100	-15.5044	
Total			-142.3558	(252)
Total energy cost			800.3042	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	821.9765	0.1569	128.9322	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2560.5500	0.1413	361.8103	(264)
Space and water heating			490.7425	(265)
Pumps, fans and electric keep-hot	195.7491	0.1387	27.1528	(267)
Energy for lighting	168.3854	0.1443	24.3032	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-504.1786	0.1322	-66.6325	
PV Unit electricity exported	-266.8574	0.1222	-32.6059	
Total			-99.2385	(269)
Total CO2, kg/year			442.9601	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	821.9765	1.5807	1299.2668	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2560.5500	1.5225	3898.4448	(278)
Space and water heating			5197.7115	(279)
Pumps, fans and electric keep-hot	195.7491	1.5128	296.1292	(281)
Energy for lighting	168.3854	1.5338	258.2751	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-504.1786	1.4883	-750.3769	
PV Unit electricity exported	-266.8574	0.4484	-119.6516	
Total			-870.0285	(283)
Total Primary energy kWh/year			4882.0873	(286)

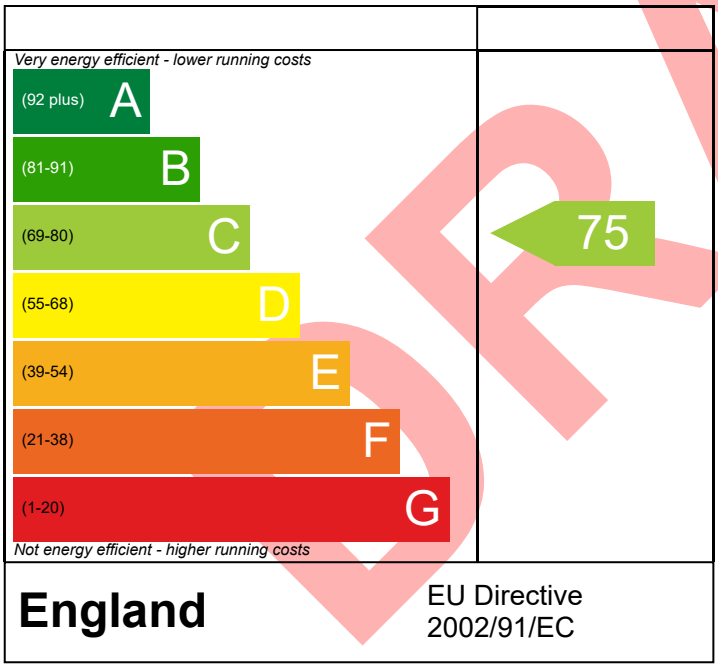
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	72.08 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

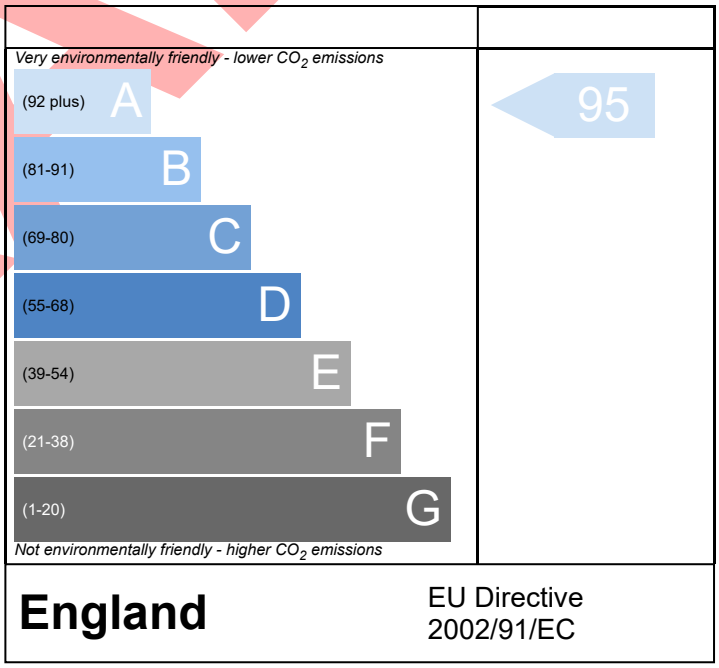
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:41

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	66 m^2
Site Reference	Unit 215 L08_Copy	Plot Reference	Unit 215 L08_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*15.06 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	7.48 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*81.26 kWh$_{PE}$/m^2*	
Dwelling primary energy	81.17 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*39.4 kWh/m^2*	
Dwelling fabric energy efficiency	37.3 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	30.83	0.14 **(!)**
Party wall: Party Wall (1)	62.14	0 **(!)**
Party wall: Party Wall (2)	4.28	0 **(!)**
Exposed roof: Roof (1)	66.5	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	7.18	South West	0.83	1.3
SE, Opening Type 1	10.77	South East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E15: Flat roof with parapet	Calculated by person with suitable expertise	0.56	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.12	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.86 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 215 L08_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 215 L08_Copy	**Prop Type Ref**	Unit 215 L08
Property			

SAP Rating	71 C	**DER**	7.48	**TER**	15.06
Environmental	94 A	**% DER < TER**			50.33
CO_2 Emissions (t/year)	0.51	**DFEE**	37.27	**TFEE**	39.40
Compliance Check	See BREL	**% DFEE < TFEE**			5.39
% DPER < TPER	0.11	**DPER**	81.17	**TPER**	81.26

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.5000	(1b)	x 3.0000	(2b) =	199.5000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		199.5000	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			17.9500	1.2357	22.1816			(27)
External Wall 1	48.7800	17.9500	30.8300	0.1400	4.3162	14.0000	431.6200	(29a)
External Roof 1	66.5000		66.5000	0.1100	7.3150	9.0000	598.5000	(30)
Total net area of external elements Aum(A, m2)			115.2800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.8128			(33)
Party Wall 1			62.1400	0.0000	0.0000	20.0000	1242.8000	(32)
Wall to corridor			4.2800	0.0000	0.0000	20.0000	85.6000	(32)
Party Floor 1			66.5000			80.0000	5320.0000	(32d)
Internal Wall 1			155.8800			9.0000	1402.9200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 9081.4400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	136.5630 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	7.7300	0.0500	0.3865

E4 Jamb	46.4000	0.0500	2.3200	
E7 Party floor between dwellings (in blocks of flats)	16.2400	0.0700	1.1368	
E18 Party wall between dwellings	6.0000	0.0600	0.3600	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	22.1400	0.0000	0.0000	
E15 Flat roof with parapet	16.2400	0.5600	9.0944	
P4 Party wall - Roof (insulation at ceiling level)	22.1400	0.1200	2.6568	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			15.9545	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	49.7673	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	19.9192	19.7094	19.4995	18.4503	18.2404	17.1912	17.1912	16.9813	17.6109	18.2404	18.6601	19.0798	(38)
Heat transfer coeff	69.6865	69.4766	69.2668	68.2175	68.0077	66.9584	66.9584	66.7486	67.3781	68.0077	68.4274	68.8471	(39)
Average = Sum(39)m / 12 =												68.1651	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0479	1.0448	1.0416	1.0258	1.0227	1.0069	1.0069	1.0037	1.0132	1.0227	1.0290	1.0353	(40)
HLP (average)												1.0250	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.1583	(42)
Hot water usage for mixer showers	83.0588	81.8106	79.9917	76.5116	73.9433	71.0793	69.4513	71.2564	73.2352	76.3103	79.8652	82.7406	(42a)
Hot water usage for baths	26.1000	25.7123	25.1665	24.1600	23.4064	22.5708	22.1194	22.6614	23.2516	24.1458	25.1729	26.0117	(42b)
Hot water usage for other uses	36.7327	35.3969	34.0612	32.7255	31.3897	30.0540	30.0540	31.3897	32.7255	34.0612	35.3969	36.7327	(42c)
Average daily hot water use (litres/day)												134.1695	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.8914	142.9198	139.2194	133.3971	128.7395	123.7040	121.6247	125.3076	129.2122	134.5173	140.4351	145.4849	(44)
Energy conte	231.0563	203.5159	213.9750	182.6139	173.3081	152.1085	147.0945	155.1570	159.3316	182.5387	200.0755	227.7943	(45)
Energy content (annual)											Total = Sum(45)m =	2228.5693	
Distribution loss (46)m = 0.15 x (45)m	34.6584	30.5274	32.0962	27.3921	25.9962	22.8163	22.0642	23.2735	23.8997	27.3808	30.0113	34.1691	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
										Total per year (kWh/year) = Sum(64)m =		2475.6013	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	93.6109	82.8294	87.9313	76.9623	74.4096	66.8193	65.6936	68.3743	69.2210	77.4788	82.7683	92.5262	(65)

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5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7552	19.3227	15.7143	11.8967	8.8930	7.5078	8.1125	10.5449	14.1533	17.9709	20.9747	22.3598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	282.0814	285.0085	277.6323	261.9291	242.1067	223.4764	211.0302	208.1031	215.4793	231.1825	251.0049	269.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	(71)
Water heating gains (Table 5)	125.8211	123.2580	118.1873	106.8921	100.0129	92.8046	88.2978	91.9010	96.1402	104.1381	114.9560	124.3632	(72)
Total internal gains	522.9304	520.8621	504.8066	473.9908	444.2853	417.0615	400.7133	403.8217	419.0457	446.5643	480.2084	509.6310	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	10.7700	36.7938	0.6300	0.8270	0.7700	143.0771	(77)
Southwest	7.1800	36.7938	0.6300	0.8270	0.7700	95.3847	(79)

Solar gains	238.4618	406.1886	555.7650	688.6198	771.3115	765.7338	738.2491	676.5573	601.7760	448.9250	285.6222	204.0736	(83)
Total gains	761.3922	927.0507	1060.5716	1162.6105	1215.5968	1182.7954	1138.9624	1080.3791	1020.8216	895.4892	765.8306	713.7046	(84)

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7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
tau	36.1996	36.3089	36.4189	36.9791	37.0932	37.6745	37.6745	37.7929	37.4398	37.0932	36.8657	36.6410	
alpha	3.4133	3.4206	3.4279	3.4653	3.4729	3.5116	3.5116	3.5195	3.4960	3.4729	3.4577	3.4427	
util living area	0.9040	0.8403	0.7526	0.6298	0.4930	0.3557	0.2570	0.2818	0.4391	0.6776	0.8513	0.9177	(86)
MIT	19.7691	20.1202	20.4654	20.7570	20.9135	20.9795	20.9950	20.9931	20.9564	20.7379	20.2212	19.6965	(87)
Th 2	20.0436	20.0462	20.0488	20.0619	20.0645	20.0776	20.0776	20.0802	20.0723	20.0645	20.0593	20.0540	(88)
util rest of house	0.8901	0.8201	0.7247	0.5935	0.4495	0.3066	0.2038	0.2264	0.3848	0.6356	0.8288	0.9055	(89)
MIT 2	18.6505	19.0753	19.4834	19.8231	19.9895	20.0636	20.0752	20.0767	20.0403	19.8151	19.2174	18.5696	(90)
Living area fraction										fLA = Living area / (4) =		0.3370	(91)
MIT	19.0275	19.4274	19.8143	20.1378	20.3009	20.3723	20.3852	20.3855	20.3490	20.1261	19.5556	18.9494	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0275	19.4274	19.8143	20.1378	20.3009	20.3723	20.3852	20.3855	20.3490	20.1261	19.5556	18.9494	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8728	0.8055	0.7173	0.5966	0.4607	0.3224	0.2216	0.2449	0.4013	0.6385	0.8152	0.8885	(94)
Useful gains	664.5245	746.7274	760.7831	693.5626	560.0596	381.3451	252.4430	264.5812	409.6454	571.7518	624.3193	634.0941	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1026.3070	1009.3137	922.2410	766.6170	584.9261	386.5011	253.4507	266.0293	421.0458	647.8479	852.3072	1015.4502	(97)
Space heating kWh	269.1662	176.4579	120.1247	52.5992	18.5007	0.0000	0.0000	0.0000	0.0000	56.6156	164.1513	283.7289	(98a)
Space heating requirement - total per year (kWh/year)												1141.3444	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	269.1662	176.4579	120.1247	52.5992	18.5007	0.0000	0.0000	0.0000	0.0000	56.6156	164.1513	283.7289	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1141.3444	
Space heating per m2										(98c) / (4) =		17.1631	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	269.1662	176.4579	120.1247	52.5992	18.5007	0.0000	0.0000	0.0000	0.0000	56.6156	164.1513	283.7289	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	269.1662	176.4579	120.1247	52.5992	18.5007	0.0000	0.0000	0.0000	0.0000	56.6156	164.1513	283.7289	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	14.4700	13.0697	14.4700	14.0033	14.4700	14.0033	14.4700	14.4700	14.0033	14.4700	14.0033	14.4700	(231)
Lighting	19.0422	15.2763	13.7546	10.0772	7.7840	6.3596	7.1008	9.2299	11.9887	15.7298	17.7668	19.5714	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.2567	-25.9458	-42.1057	-52.5672	-61.0010	-58.1000	-57.1810	-51.5957	-42.1239	-31.2994	-18.7334	-13.6886	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.6984	-6.5489	-15.1578	-26.3561	-37.9436	-39.6570	-39.0901	-31.6426	-21.6112	-10.7995	-3.9293	-2.0476	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1141.3444	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2475.6013	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	170.3730	(230a)
Total electricity for the above, kWh/year	170.3730	(231)
Electricity for lighting (calculated in Appendix L)	153.6812	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-708.0805	(233)
Wind generation	0.0000	(234)

Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3232.9195	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1141.3444	16.4900	188.2077	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	16.4900	408.2267	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	170.3730	16.4900	28.0945	(249)
Energy for lighting	153.6812	16.4900	25.3420	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-470.5981	16.4900	-77.6016	
PV Unit electricity exported	-237.4823	5.5900	-13.2753	
Total			-90.8769	(252)
Total energy cost			558.9940	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.8048	(257)
SAP value		70.7438	
SAP rating (Section 12)		71	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1141.3444	0.1570	179.1846	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2475.6013	0.1413	349.7834	(264)
Space and water heating			528.9680	(265)
Pumps, fans and electric keep-hot	170.3730	0.1387	23.6328	(267)
Energy for lighting	153.6812	0.1443	22.1809	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-470.5981	0.1325	-62.3662	
PV Unit electricity exported	-237.4823	0.1222	-29.0307	
Total			-91.3969	(269)
Total CO2, kg/year			483.3849	(272)
CO2 emissions per m2			7.2700	(273)
EI value			94.1907	
EI rating			94	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.5000 (1b)	x	3.0000 (2b)	=	199.5000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	199.5000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			17.9500	1.2357	22.1816			(27)
External Wall 1	48.7800	17.9500	30.8300	0.1400	4.3162	14.0000	431.6200	(29a)
External Roof 1	66.5000		66.5000	0.1100	7.3150	9.0000	598.5000	(30)
Total net area of external elements Aum(A, m2)			115.2800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.8128			(33)
Party Wall 1			62.1400	0.0000	0.0000	20.0000	1242.8000	(32)
Wall to corridor			4.2800	0.0000	0.0000	20.0000	85.6000	(32)
Party Floor 1			66.5000			80.0000	5320.0000	(32d)
Internal Wall 1			155.8800			9.0000	1402.9200	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9081.4400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 136.5630 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	7.7300	0.0500	0.3865
E4 Jamb	46.4000	0.0500	2.3200
E7 Party floor between dwellings (in blocks of flats)	16.2400	0.0700	1.1368
E18 Party wall between dwellings	6.0000	0.0600	0.3600
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	22.1400	0.0000	0.0000
E15 Flat roof with parapet	16.2400	0.5600	9.0944
P4 Party wall - Roof (insulation at ceiling level)	22.1400	0.1200	2.6568

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 15.9545 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 49.7673 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	20.1291	20.1291	19.7094	18.4503	18.2404	17.4010	16.9813	16.9813	17.8207	18.8700	19.2897	19.0798	(38)
Heat transfer coeff	69.8963	69.8963	69.4766	68.2175	68.0077	67.1683	66.7486	66.7486	67.5880	68.6372	69.0569	68.8471	(39)

Average = Sum(39)m / 12 = 68.3574

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0511	1.0511	1.0448	1.0258	1.0227	1.0100	1.0037	1.0037	1.0164	1.0321	1.0384	1.0353	(40)
HLP (average)												1.0279	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1583 (42)
Hot water usage for mixer showers

83.0588	81.8106	79.9917	76.5116	73.9433	71.0793	69.4513	71.2564	73.2352	76.3103	79.8652	82.7406	(42a)

Hot water usage for baths

26.1000	25.7123	25.1665	24.1600	23.4064	22.5708	22.1194	22.6614	23.2516	24.1458	25.1729	26.0117	(42b)

Hot water usage for other uses

36.7327	35.3969	34.0612	32.7255	31.3897	30.0540	30.0540	31.3897	32.7255	34.0612	35.3969	36.7327	(42c)

Average daily hot water use (litres/day) 134.1695 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.8914	142.9198	139.2194	133.3971	128.7395	123.7040	121.6247	125.3076	129.2122	134.5173	140.4351	145.4849	(44)
Energy conte	231.0563	203.5159	213.9750	182.6139	173.3081	152.1085	147.0945	155.1570	159.3316	182.5387	200.0755	227.7943	(45)
Energy content (annual)											Total = Sum(45)m =	2228.5693	
Distribution loss (46)m = 0.15 x (45)m	34.6584	30.5274	32.0962	27.3921	25.9962	22.8163	22.0642	23.2735	23.8997	27.3808	30.0113	34.1691	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
									Total per year (kWh/year) = Sum(64)m =		2475.6013	(64)
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
93.6109	82.8294	87.9313	76.9623	74.4096	66.8193	65.6936	68.3743	69.2210	77.4788	82.7683	92.5262	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.7552	19.3227	15.7143	11.8967	8.8930	7.5078	8.1125	10.5449	14.1533	17.9709	20.9747	22.3598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	282.0814	285.0085	277.6323	261.9291	242.1067	223.4764	211.0302	208.1031	215.4793	231.1825	251.0049	269.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	(71)
Water heating gains (Table 5)													
	125.8211	123.2580	118.1873	106.8921	100.0129	92.8046	88.2978	91.9010	96.1402	104.1381	114.9560	124.3632	(72)
Total internal gains													
	522.9304	520.8621	504.8066	473.9908	444.2853	417.0615	400.7133	403.8217	419.0457	446.5643	480.2084	509.6310	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	10.7700	33.4622	0.6300	0.8270	0.7700	130.1217	(77)
Southwest	7.1800	33.4622	0.6300	0.8270	0.7700	86.7478	(79)

Solar gains	216.8696	394.2722	563.7846	734.8050	814.7097	786.0956	767.2902	683.7861	604.9927	433.1436	266.9540	189.8007	(83)
Total gains	739.8000	915.1343	1068.5913	1208.7958	1258.9950	1203.1571	1168.0034	1087.6078	1024.0384	879.7078	747.1624	699.4317	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.0909	36.0909	36.3089	36.9791	37.0932	37.5568	37.7929	37.7929	37.3235	36.7530	36.5296	36.6410	
alpha	3.4061	3.4061	3.4206	3.4653	3.4729	3.5038	3.5195	3.5195	3.4882	3.4502	3.4353	3.4427	
util living area													
	0.9154	0.8566	0.7743	0.6479	0.5216	0.4218	0.3430	0.3725	0.5101	0.7242	0.8704	0.9271	(86)
MIT	19.6603	20.0086	20.3715	20.7122	20.8859	20.9569	20.9828	20.9773	20.9167	20.6398	20.1068	19.5902	(87)
Th 2	20.0410	20.0410	20.0462	20.0619	20.0645	20.0750	20.0802	20.0802	20.0697	20.0566	20.0514	20.0540	(88)
util rest of house													
	0.9031	0.8384	0.7490	0.6146	0.4812	0.3754	0.2932	0.3199	0.4598	0.6867	0.8505	0.9164	(89)
MIT 2	18.5142	18.9359	19.3701	19.7717	19.9608	20.0412	20.0689	20.0649	20.0010	19.7004	19.0738	18.4370	(90)
Living area fraction									fLA = Living area / (4) =			0.3370	(91)
MIT	18.9004	19.2974	19.7076	20.0886	20.2726	20.3498	20.3769	20.3724	20.3096	20.0169	19.4219	18.8256	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9004	19.2974	19.7076	20.0886	20.2726	20.3498	20.3769	20.3724	20.3096	20.0169	19.4219	18.8256	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8856	0.8224	0.7393	0.6155	0.4904	0.3894	0.3094	0.3368	0.4731	0.6850	0.8353	0.8994	(94)
Useful gains	655.1859	752.6338	789.9782	744.0634	617.4312	468.4971	361.3394	366.2988	484.4421	602.6171	624.0993	629.0856	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	1048.4730	1048.2609	980.1458	831.4789	651.0079	480.2374	365.5732	371.9491	507.5585	708.1260	885.4425	1041.3545	(97)
Space heating kWh													
	292.6056	198.6614	141.4848	62.9392	24.9811	0.0000	0.0000	0.0000	0.0000	78.4986	188.1671	306.7281	(98a)
Space heating requirement - total per year (kWh/year)												1294.0658	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	292.6056	198.6614	141.4848	62.9392	24.9811	0.0000	0.0000	0.0000	0.0000	78.4986	188.1671	306.7281	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1294.0658	
Space heating per m2											(98c) / (4) =	19.4596	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	292.6056	198.6614	141.4848	62.9392	24.9811	0.0000	0.0000	0.0000	0.0000	78.4986	188.1671	306.7281	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	292.6056	198.6614	141.4848	62.9392	24.9811	0.0000	0.0000	0.0000	0.0000	78.4986	188.1671	306.7281	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
Efficiency of water heater												100.0000	(216)

(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	14.4700	13.0697	14.4700	14.0033	14.4700	14.0033	14.4700	14.4700	14.0033	14.4700	14.0033	14.4700	(231)
Lighting	19.0422	15.2763	13.7546	10.0772	7.7840	6.3596	7.1008	9.2299	11.9887	15.7298	17.7668	19.5714	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.7245	-25.0255	-42.3209	-55.0709	-63.4042	-58.9451	-58.5062	-51.6114	-41.8459	-30.1642	-17.4482	-12.6515	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.2641	-6.0370	-14.9230	-28.1697	-40.2523	-40.7576	-40.8273	-31.6605	-21.3565	-9.8376	-3.4204	-1.7765	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1294.0658	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2475.6013	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	170.3730	(230a)
Total electricity for the above, kWh/year	170.3730	(231)
Electricity for lighting (calculated in Appendix L)	153.6812	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-713.0011	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3380.7203	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1294.0658	25.1600	325.5870	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	25.1600	622.8613	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	170.3730	25.1600	42.8658	(249)
Energy for lighting	153.6812	25.1600	38.6662	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-471.7185	25.1600	-118.6844	
PV Unit electricity exported	-241.2826	5.8100	-14.0185	
Total			-132.7029	(252)
Total energy cost			897.2774	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1294.0658	0.1565	202.5112	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2475.6013	0.1413	349.7834	(264)
Space and water heating			552.2947	(265)
Pumps, fans and electric keep-hot	170.3730	0.1387	23.6328	(267)
Energy for lighting	153.6812	0.1443	22.1809	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-471.7185	0.1322	-62.3762	
PV Unit electricity exported	-241.2826	0.1217	-29.3605	
Total			-91.7368	(269)
Total CO2, kg/year			506.3717	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1294.0658	1.5793	2043.7318	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	1.5225	3769.0221	(278)
Space and water heating			5812.7539	(279)
Pumps, fans and electric keep-hot	170.3730	1.5128	257.7403	(281)
Energy for lighting	153.6812	1.5338	235.7213	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-471.7185	1.4886	-702.1935	
PV Unit electricity exported	-241.2826	0.4465	-107.7330	
Total			-809.9265	(283)
Total Primary energy kWh/year			5496.2890	(286)

SAP 10 EPC IMPROVEMENTS

Unit 215 L08_Copy

Current energy efficiency rating: C 71
Current environmental impact rating: A 94

N Solar water heating	Not applicable
U Solar photovoltaic panels	Not applicable
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 71
Potential environmental impact rating: A 94

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£1030	£1030	£0
Space heating	£368	£368	£0
Water heating	£623	£623	£0
Lighting	£39	£39	£0
Generated (PV)	-£133	-£133	£0
Total cost of fuels	£897	£897	£0
Total cost of uses	£897	£897	£0
Delivered energy	51 kWh/m²	51 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.5 tonnes	0.0 tonnes
CO2 emissions per m²	8 kg/m²	8 kg/m²	0 kg/m²
Primary energy	83 kWh/m²	83 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.5000 (1b)	x	3.0000 (2b)	=	199.5000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	199.5000	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			17.9500	1.2357	22.1816			(27)
External Wall 1	48.7800	17.9500	30.8300	0.1400	4.3162	14.0000	431.6200	(29a)
External Roof 1	66.5000		66.5000	0.1100	7.3150	9.0000	598.5000	(30)
Total net area of external elements Aum(A, m2)			115.2800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.8128			(33)
Party Wall 1			62.1400	0.0000	0.0000	20.0000	1242.8000	(32)
Wall to corridor			4.2800	0.0000	0.0000	20.0000	85.6000	(32)
Party Floor 1			66.5000			80.0000	5320.0000	(32d)
Internal Wall 1			155.8800			9.0000	1402.9200	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9081.4400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 136.5630 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	7.7300	0.0500	0.3865
E4 Jamb	46.4000	0.0500	2.3200
E7 Party floor between dwellings (in blocks of flats)	16.2400	0.0700	1.1368
E18 Party wall between dwellings	6.0000	0.0600	0.3600
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	22.1400	0.0000	0.0000
E15 Flat roof with parapet	16.2400	0.5600	9.0944
P4 Party wall - Roof (insulation at ceiling level)	22.1400	0.1200	2.6568

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 15.9545 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 49.7673 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	19.9192	19.7094	19.4995	18.4503	18.2404	17.1912	17.1912	16.9813	17.6109	18.2404	18.6601	19.0798	(38)
Heat transfer coeff	69.6865	69.4766	69.2668	68.2175	68.0077	66.9584	66.9584	66.7486	67.3781	68.0077	68.4274	68.8471	(39)
Average = Sum(39)m / 12 =												68.1651	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0479	1.0448	1.0416	1.0258	1.0227	1.0069	1.0069	1.0037	1.0132	1.0227	1.0290	1.0353	(40)
HLP (average)												1.0250	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1583 (42)
Hot water usage for mixer showers

83.0588	81.8106	79.9917	76.5116	73.9433	71.0793	69.4513	71.2564	73.2352	76.3103	79.8652	82.7406	(42a)

Hot water usage for baths

26.1000	25.7123	25.1665	24.1600	23.4064	22.5708	22.1194	22.6614	23.2516	24.1458	25.1729	26.0117	(42b)

Hot water usage for other uses

36.7327	35.3969	34.0612	32.7255	31.3897	30.0540	30.0540	31.3897	32.7255	34.0612	35.3969	36.7327	(42c)

Average daily hot water use (litres/day) 134.1695 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.8914	142.9198	139.2194	133.3971	128.7395	123.7040	121.6247	125.3076	129.2122	134.5173	140.4351	145.4849	(44)
Energy conte	231.0563	203.5159	213.9750	182.6139	173.3081	152.1085	147.0945	155.1570	159.3316	182.5387	200.0755	227.7943	(45)
Energy content (annual)										Total = Sum(45)m =		2228.5693	
Distribution loss (46)m = 0.15 x (45)m	34.6584	30.5274	32.0962	27.3921	25.9962	22.8163	22.0642	23.2735	23.8997	27.3808	30.0113	34.1691	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
									Total per year (kWh/year) = Sum(64)m =		2475.6013	(64)
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

93.6109	82.8294	87.9313	76.9623	74.4096	66.8193	65.6936	68.3743	69.2210	77.4788	82.7683	92.5262	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7552	19.3227	15.7143	11.8967	8.8930	7.5078	8.1125	10.5449	14.1533	17.9709	20.9747	22.3598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	282.0814	285.0085	277.6323	261.9291	242.1067	223.4764	211.0302	208.1031	215.4793	231.1825	251.0049	269.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(70)
Losses e.g. evaporation (negative values) (Table 5)	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	(71)
Water heating gains (Table 5)													

	125.8211	123.2580	118.1873	106.8921	100.0129	92.8046	88.2978	91.9010	96.1402	104.1381	114.9560	124.3632	(72)
Total internal gains													
	522.9304	520.8621	504.8066	473.9908	444.2853	417.0615	400.7133	403.8217	419.0457	446.5643	480.2084	509.6310	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	10.7700	36.7938	0.6300	0.8270	0.7700	143.0771	(77)
Southwest	7.1800	36.7938	0.6300	0.8270	0.7700	95.3847	(79)

Solar gains	238.4618	406.1886	555.7650	688.6198	771.3115	765.7338	738.2491	676.5573	601.7760	448.9250	285.6222	204.0736	(83)
Total gains	761.3922	927.0507	1060.5716	1162.6105	1215.5968	1182.7954	1138.9624	1080.3791	1020.8216	895.4892	765.8306	713.7046	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.1996	36.3089	36.4189	36.9791	37.0932	37.6745	37.6745	37.7929	37.4398	37.0932	36.8657	36.6410	
alpha	3.4133	3.4206	3.4279	3.4653	3.4729	3.5116	3.5116	3.5195	3.4960	3.4729	3.4577	3.4427	
util living area													
	0.9040	0.8403	0.7526	0.6298	0.4930	0.3557	0.2570	0.2818	0.4391	0.6776	0.8513	0.9177	(86)
MIT	19.7691	20.1202	20.4654	20.7570	20.9135	20.9795	20.9950	20.9931	20.9564	20.7379	20.2212	19.6965	(87)
Th 2	20.0436	20.0462	20.0488	20.0619	20.0645	20.0776	20.0776	20.0802	20.0723	20.0645	20.0593	20.0540	(88)
util rest of house													
	0.8901	0.8201	0.7247	0.5935	0.4495	0.3066	0.2038	0.2264	0.3848	0.6356	0.8288	0.9055	(89)
MIT 2	18.6505	19.0753	19.4834	19.8231	19.9895	20.0636	20.0752	20.0767	20.0403	19.8151	19.2174	18.5696	(90)
Living area fraction									fLA = Living area / (4) =			0.3370	(91)
MIT	19.0275	19.4274	19.8143	20.1378	20.3009	20.3723	20.3852	20.3855	20.3490	20.1261	19.5556	18.9494	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0275	19.4274	19.8143	20.1378	20.3009	20.3723	20.3852	20.3855	20.3490	20.1261	19.5556	18.9494	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8728	0.8055	0.7173	0.5966	0.4607	0.3224	0.2216	0.2449	0.4013	0.6385	0.8152	0.8885	(94)
Useful gains	664.5245	746.7274	760.7831	693.5626	560.0596	381.3451	252.4430	264.5812	409.6454	571.7518	624.3193	634.0941	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1026.3070	1009.3137	922.2410	766.6170	584.9261	386.5011	253.4507	266.0293	421.0458	647.8479	852.3072	1015.4502	(97)
Space heating kWh													
	269.1662	176.4579	120.1247	52.5992	18.5007	0.0000	0.0000	0.0000	0.0000	56.6156	164.1513	283.7289	(98a)
Space heating requirement - total per year (kWh/year)												1141.3444	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	269.1662	176.4579	120.1247	52.5992	18.5007	0.0000	0.0000	0.0000	0.0000	56.6156	164.1513	283.7289	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1141.3444	
Space heating per m2										(98c) / (4) =		17.1631	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	269.1662	176.4579	120.1247	52.5992	18.5007	0.0000	0.0000	0.0000	0.0000	56.6156	164.1513	283.7289	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	269.1662	176.4579	120.1247	52.5992	18.5007	0.0000	0.0000	0.0000	0.0000	56.6156	164.1513	283.7289	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	14.4700	13.0697	14.4700	14.0033	14.4700	14.0033	14.4700	14.4700	14.0033	14.4700	14.0033	14.4700	(231)
Lighting	19.0422	15.2763	13.7546	10.0772	7.7840	6.3596	7.1008	9.2299	11.9887	15.7298	17.7668	19.5714	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.2567	-25.9458	-42.1057	-52.5672	-61.0010	-58.1000	-57.1810	-51.5957	-42.1239	-31.2994	-18.7334	-13.6886	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													

(233b)m	-2.6984	-6.5489	-15.1578	-26.3561	-37.9436	-39.6570	-39.0901	-31.6426	-21.6112	-10.7995	-3.9293	-2.0476	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1141.3444	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2475.6013	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	170.3730	(230a)
Total electricity for the above, kWh/year	170.3730	(231)
Electricity for lighting (calculated in Appendix L)	153.6812	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-708.0805	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3232.9195	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1141.3444	16.4900	188.2077	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	16.4900	408.2267	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	170.3730	16.4900	28.0945	(249)
Energy for lighting	153.6812	16.4900	25.3420	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-470.5981	16.4900	-77.6016	
PV Unit electricity exported	-237.4823	5.5900	-13.2753	
Total			-90.8769	(252)
Total energy cost			558.9940	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.8048	(257)
SAP value		70.7438	
SAP rating (Section 12)		71	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1141.3444	0.1570	179.1846	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2475.6013	0.1413	349.7834	(264)
Space and water heating			528.9680	(265)
Pumps, fans and electric keep-hot	170.3730	0.1387	23.6328	(267)
Energy for lighting	153.6812	0.1443	22.1809	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-470.5981	0.1325	-62.3662	
PV Unit electricity exported	-237.4823	0.1222	-29.0307	
Total			-91.3969	(269)
Total CO2, kg/year			483.3849	(272)
CO2 emissions per m2			7.2700	(273)
EI value			94.1907	
EI rating			94	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		66.5000 (1b)	x	3.0000 (2b)	=	199.5000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.5000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	199.5000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			17.9500	1.2357	22.1816			(27)
External Wall 1	48.7800	17.9500	30.8300	0.1400	4.3162	14.0000	431.6200	(29a)
External Roof 1	66.5000		66.5000	0.1100	7.3150	9.0000	598.5000	(30)
Total net area of external elements Aum(A, m2)			115.2800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.8128			(33)
Party Wall 1			62.1400	0.0000	0.0000	20.0000	1242.8000	(32)
Wall to corridor			4.2800	0.0000	0.0000	20.0000	85.6000	(32)
Party Floor 1			66.5000			80.0000	5320.0000	(32d)
Internal Wall 1			155.8800			9.0000	1402.9200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9081.4400	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		136.5630	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	7.7300	0.0500	0.3865
E2 Other lintels (including other steel lintels)	46.4000	0.0500	2.3200
E4 Jamb	16.2400	0.0700	1.1368
E7 Party floor between dwellings (in blocks of flats)	6.0000	0.0600	0.3600
E18 Party wall between dwellings	22.1400	0.0000	0.0000
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.2400	0.5600	9.0944
E15 Flat roof with parapet	22.1400	0.1200	2.6568
P4 Party wall - Roof (insulation at ceiling level)			

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		15.9545	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	49.7673	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	20.1291	20.1291	19.7094	18.4503	18.2404	17.4010	16.9813	16.9813	17.8207	18.8700	19.2897	19.0798	(38)
Heat transfer coeff	69.8963	69.8963	69.4766	68.2175	68.0077	67.1683	66.7486	66.7486	67.5880	68.6372	69.0569	68.8471	(39)
Average = Sum(39)m / 12 =												68.3574	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0511	1.0511	1.0448	1.0258	1.0227	1.0100	1.0037	1.0037	1.0164	1.0321	1.0384	1.0353	(40)
HLP (average)												1.0279	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1583	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
83.0588	81.8106	79.9917	76.5116	73.9433	71.0793	69.4513	71.2564	73.2352	76.3103	79.8652	82.7406	(42a)

Hot water usage for baths

26.1000	25.7123	25.1665	24.1600	23.4064	22.5708	22.1194	22.6614	23.2516	24.1458	25.1729	26.0117	(42b)

Hot water usage for other uses

36.7327	35.3969	34.0612	32.7255	31.3897	30.0540	30.0540	31.3897	32.7255	34.0612	35.3969	36.7327	(42c)

Average daily hot water use (litres/day)	134.1695	(43)

Daily hot water use

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
145.8914	142.9198	139.2194	133.3971	128.7395	123.7040	121.6247	125.3076	129.2122	134.5173	140.4351	145.4849	(44)
Energy conte 231.0563	203.5159	213.9750	182.6139	173.3081	152.1085	147.0945	155.1570	159.3316	182.5387	200.0755	227.7943	(45)
Energy content (annual)										Total = Sum(45)m =		2228.5693	

Distribution loss (46)m = 0.15 x (45)m

34.6584	30.5274	32.0962	27.3921	25.9962	22.8163	22.0642	23.2735	23.8997	27.3808	30.0113	34.1691	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)

Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
										Total per year (kWh/year) = Sum(64)m =		2475.6013	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	93.6109	82.8294	87.9313	76.9623	74.4096	66.8193	65.6936	68.3743	69.2210	77.4788	82.7683	92.5262	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.7552	19.3227	15.7143	11.8967	8.8930	7.5078	8.1125	10.5449	14.1533	17.9709	20.9747	22.3598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	282.0814	285.0085	277.6323	261.9291	242.1067	223.4764	211.0302	208.1031	215.4793	231.1825	251.0049	269.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	(71)
Water heating gains (Table 5)													
	125.8211	123.2580	118.1873	106.8921	100.0129	92.8046	88.2978	91.9010	96.1402	104.1381	114.9560	124.3632	(72)
Total internal gains													
	522.9304	520.8621	504.8066	473.9908	444.2853	417.0615	400.7133	403.8217	419.0457	446.5643	480.2084	509.6310	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	10.7700	33.4622	0.6300	0.8270	0.7700	130.1217	(77)
Southwest	7.1800	33.4622	0.6300	0.8270	0.7700	86.7478	(79)

Solar gains	216.8696	394.2722	563.7846	734.8050	814.7097	786.0956	767.2902	683.7861	604.9927	433.1436	266.9540	189.8007	(83)
Total gains	739.8000	915.1343	1068.5913	1208.7958	1258.9950	1203.1571	1168.0034	1087.6078	1024.0384	879.7078	747.1624	699.4317	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.0909	36.0909	36.3089	36.9791	37.0932	37.5568	37.7929	37.7929	37.3235	36.7530	36.5296	36.6410	
alpha	3.4061	3.4061	3.4206	3.4653	3.4729	3.5038	3.5195	3.5195	3.4882	3.4502	3.4353	3.4427	
util living area													
	0.9154	0.8566	0.7743	0.6479	0.5216	0.4218	0.3430	0.3725	0.5101	0.7242	0.8704	0.9271	(86)
MIT	19.6603	20.0086	20.3715	20.7122	20.8859	20.9569	20.9828	20.9773	20.9167	20.6398	20.1068	19.5902	(87)
Th 2	20.0410	20.0410	20.0462	20.0619	20.0645	20.0750	20.0802	20.0802	20.0697	20.0566	20.0514	20.0540	(88)
util rest of house													
	0.9031	0.8384	0.7490	0.6146	0.4812	0.3754	0.2932	0.3199	0.4598	0.6867	0.8505	0.9164	(89)
MIT 2	18.5142	18.9359	19.3701	19.7717	19.9608	20.0412	20.0689	20.0649	20.0010	19.7004	19.0738	18.4370	(90)
Living area fraction										fLA = Living area / (4) =		0.3370	(91)
MIT	18.9004	19.2974	19.7076	20.0886	20.2726	20.3498	20.3769	20.3724	20.3096	20.0169	19.4219	18.8256	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9004	19.2974	19.7076	20.0886	20.2726	20.3498	20.3769	20.3724	20.3096	20.0169	19.4219	18.8256	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8856	0.8224	0.7393	0.6155	0.4904	0.3894	0.3094	0.3368	0.4731	0.6850	0.8353	0.8994	(94)
Useful gains	655.1859	752.6338	789.9782	744.0634	617.4312	468.4971	361.3394	366.2988	484.4421	602.6171	624.0993	629.0856	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	1048.4730	1048.2609	980.1458	831.4789	651.0079	480.2374	365.5732	371.9491	507.5585	708.1260	885.4425	1041.3545	(97)
Space heating kWh													
	292.6056	198.6614	141.4848	62.9392	24.9811	0.0000	0.0000	0.0000	0.0000	78.4986	188.1671	306.7281	(98a)
Space heating requirement - total per year (kWh/year)												1294.0658	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	292.6056	198.6614	141.4848	62.9392	24.9811	0.0000	0.0000	0.0000	0.0000	78.4986	188.1671	306.7281	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1294.0658	
Space heating per m2											(98c) / (4) =	19.4596	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	292.6056	198.6614	141.4848	62.9392	24.9811	0.0000	0.0000	0.0000	0.0000	78.4986	188.1671	306.7281	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	292.6056	198.6614	141.4848	62.9392	24.9811	0.0000	0.0000	0.0000	0.0000	78.4986	188.1671	306.7281	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	14.4700	13.0697	14.4700	14.0033	14.4700	14.0033	14.4700	14.4700	14.0033	14.4700	14.0033	14.4700	(231)
Lighting	19.0422	15.2763	13.7546	10.0772	7.7840	6.3596	7.1008	9.2299	11.9887	15.7298	17.7668	19.5714	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.7245	-25.0255	-42.3209	-55.0709	-63.4042	-58.9451	-58.5062	-51.6114	-41.8459	-30.1642	-17.4482	-12.6515	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.2641	-6.0370	-14.9230	-28.1697	-40.2523	-40.7576	-40.8273	-31.6605	-21.3565	-9.8376	-3.4204	-1.7765	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1294.0658	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2475.6013	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)													
mechanical ventilation fans (SFP = 0.7000)												170.3730	(230a)
Total electricity for the above, kWh/year												170.3730	(231)
Electricity for lighting (calculated in Appendix L)												153.6812	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-713.0011	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3380.7203	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1294.0658	25.1600	325.5870	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	25.1600	622.8613	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	170.3730	25.1600	42.8658	(249)
Energy for lighting	153.6812	25.1600	38.6662	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-471.7185	25.1600	-118.6844	
PV Unit electricity exported	-241.2826	5.8100	-14.0185	
Total			-132.7029	(252)
Total energy cost			897.2774	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1294.0658	0.1565	202.5112	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2475.6013	0.1413	349.7834	(264)
Space and water heating			552.2947	(265)
Pumps, fans and electric keep-hot	170.3730	0.1387	23.6328	(267)
Energy for lighting	153.6812	0.1443	22.1809	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-471.7185	0.1322	-62.3762	
PV Unit electricity exported	-241.2826	0.1217	-29.3605	
Total			-91.7368	(269)
Total CO2, kg/year			506.3717	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1294.0658	1.5793	2043.7318	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	1.5225	3769.0221	(278)
Space and water heating			5812.7539	(279)
Pumps, fans and electric keep-hot	170.3730	1.5128	257.7403	(281)
Energy for lighting	153.6812	1.5338	235.7213	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-471.7185	1.4886	-702.1935	
PV Unit electricity exported	-241.2826	0.4465	-107.7330	
Total			-809.9265	(283)
Total Primary energy kWh/year			5496.2890	(286)

Predicted Energy Assessment

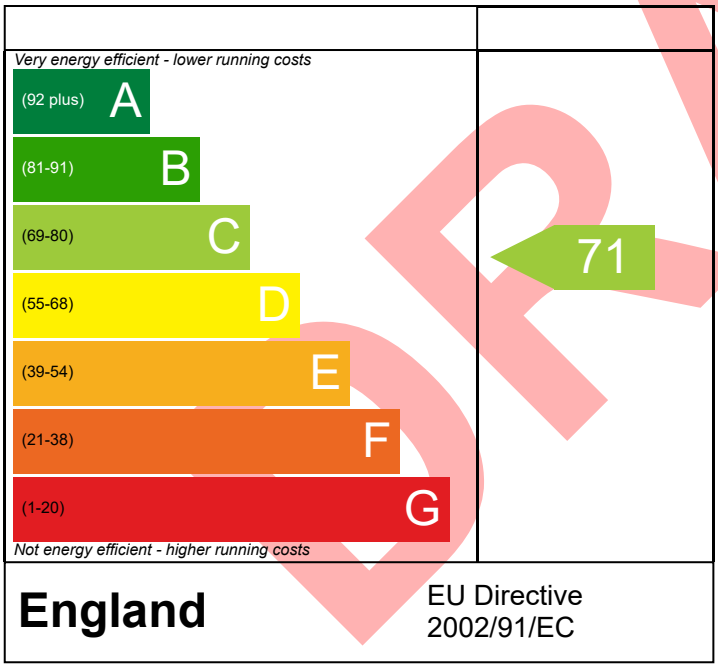
elmhurst energy

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	66.5 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

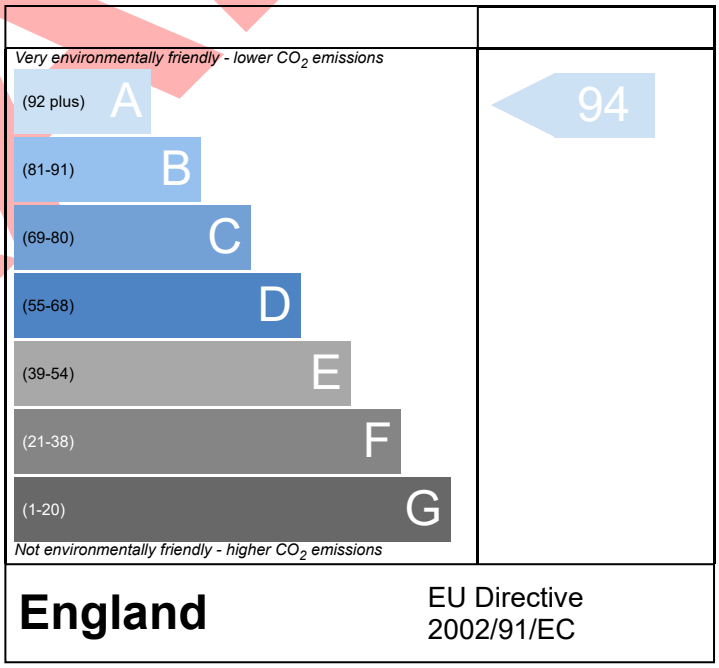
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:41

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	51 m^2
Site Reference	Unit 216 L08_Copy	Plot Reference	Unit 216 L08_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*14.83 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	6.96 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*80.45 kWh_{PE}/m^2*	
Dwelling primary energy	76.5 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*30.3 kWh/m^2*	
Dwelling fabric energy efficiency	28.4 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	*1.6*	1.3	SE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	10.37	0.14 **(!)**
Party wall: Party Wall (1)	52.8	0 **(!)**
Party wall: Party Wall (2)	17.55	0 **(!)**
Exposed roof: Roof (1)	51.48	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SE, Opening Type 1	7.18	South East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E15: Flat roof with parapet	Calculated by person with suitable expertise	0.56	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.12	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.67 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 216 L08_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 216 L08_Copy	**Prop Type Ref**	Unit 216 L08
Property			

SAP Rating	75 C	**DER**	6.96	**TER**	14.83
Environmental	95 A	**% DER < TER**			53.07
CO_2 Emissions (t/year)	0.36	**DFEE**	28.42	**TFEE**	30.31
Compliance Check	See BREL	**% DFEE < TFEE**			6.25
% DPER < TPER	4.91	**DPER**	76.50	**TPER**	80.45

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.4800	(1b)	x 3.0000	(2b) =	154.4400	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.4800					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		154.4400	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												72.0000	(23c)
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.1800	1.2357	8.8726			(27)
External Wall 1	17.5500	7.1800	10.3700	0.1400	1.4518	14.0000	145.1800	(29a)
External Roof 1	51.4800		51.4800	0.1100	5.6628	9.0000	463.3200	(30)
Total net area of external elements Aum(A, m2)			69.0300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	15.9872			(33)
Party Wall 1			52.8000	0.0000	0.0000	20.0000	1056.0000	(32)
Wall to corridor			17.5500	0.0000	0.0000	20.0000	351.0000	(32)
Party Floor 1			51.4800			80.0000	4118.4000	(32d)
Internal Wall 1			89.1000			9.0000	801.9000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	6935.8000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		134.7280 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.0900	0.0500	0.1545

E4 Jamb	18.5600	0.0500	0.9280	
E7 Party floor between dwellings (in blocks of flats)	5.8500	0.0700	0.4095	
E18 Party wall between dwellings	6.0000	0.0600	0.3600	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.4500	0.0000	0.0000	
E15 Flat roof with parapet	5.8500	0.5600	3.2760	
P4 Party wall - Roof (insulation at ceiling level)	23.4500	0.1200	2.8140	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.9420 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 23.9292 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	14.6891	14.5410	14.3929	13.6523	13.5042	12.7636	12.7636	12.6155	13.0598	13.5042	13.8004	14.0967	(38)
Heat transfer coeff	38.6183	38.4702	38.3221	37.5815	37.4334	36.6928	36.6928	36.5447	36.9891	37.4334	37.7296	38.0259	(39)
Average = Sum(39)m / 12 =												37.5445	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7502	0.7473	0.7444	0.7300	0.7271	0.7128	0.7128	0.7099	0.7185	0.7271	0.7329	0.7387	(40)
HLP (average)												0.7293	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7337 (42)
Hot water usage for mixer showers

73.2716	72.1705	70.5659	67.4959	65.2303	62.7037	61.2676	62.8600	64.6056	67.3184	70.4543	72.9909	(42a)

Hot water usage for baths

23.0390	22.6968	22.2150	21.3266	20.6614	19.9237	19.5253	20.0037	20.5247	21.3140	22.2207	22.9611	(42b)

Hot water usage for other uses

32.3851	31.2075	30.0298	28.8522	27.6746	26.4969	26.4969	27.6746	28.8522	30.0298	31.2075	32.3851	(42c)

Average daily hot water use (litres/day) 118.3558 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.6957	126.0748	122.8108	117.6747	113.5662	109.1243	107.2898	110.5383	113.9825	118.6622	123.8825	128.3371	(44)
Energy conte	203.8226	179.5288	188.7556	161.0907	152.8819	134.1811	129.7577	136.8695	140.5518	161.0235	176.4934	200.9449	(45)
Energy content (annual)										Total = Sum(45)m =		1965.9015	
Distribution loss (46)m = 0.15 x (45)m	30.5734	26.9293	28.3133	24.1636	22.9323	20.1272	19.4636	20.5304	21.0828	24.1535	26.4740	30.1417	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
										Total per year (kWh/year) = Sum(64)m =		2212.9335	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	84.5557	74.8537	79.5459	69.8059	67.6179	60.8584	59.9291	62.2937	62.9767	70.3250	74.9273	83.5988	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.0400	16.0230	13.0308	9.8651	7.3743	6.2257	6.7271	8.7441	11.7363	14.9020	17.3928	18.5414	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	225.4877	227.8276	221.9312	209.3786	193.5331	178.6406	168.6914	166.3516	172.2479	184.8006	200.6461	215.5386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	(71)
Water heating gains (Table 5)	113.6501	111.3894	106.9165	96.9526	90.8842	84.5256	80.5498	83.7281	87.4676	94.5228	104.0656	112.3640	(72)
Total internal gains	438.9885	437.0507	423.6892	398.0070	373.6023	351.2025	337.7790	340.6346	353.2626	376.0361	403.9152	428.2547	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.1800	36.7938	0.6300	0.8270	0.7700	95.3847	(77)

Solar gains	95.3847	162.4755	222.3060	275.4479	308.5246	306.2935	295.2996	270.6229	240.7104	179.5700	114.2489	81.6294	(83)
Total gains	534.3732	599.5261	645.9952	673.4549	682.1269	657.4960	633.0787	611.2575	593.9730	555.6061	518.1641	509.8842	(84)

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7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	49.8885	50.0806	50.2741	51.2648	51.4677	52.5065	52.5065	52.7193	52.0860	51.4677	51.0636	50.6658	
alpha	4.3259	4.3387	4.3516	4.4177	4.4312	4.5004	4.5004	4.5146	4.4724	4.4312	4.4042	4.3777	
util living area	0.8799	0.8257	0.7473	0.6313	0.4973	0.3549	0.2546	0.2744	0.4240	0.6500	0.8198	0.8929	(86)
MIT	20.3533	20.5394	20.7297	20.8898	20.9669	20.9945	20.9990	20.9987	20.9874	20.8949	20.6292	20.3182	(87)
Th 2	20.2967	20.2993	20.3018	20.3144	20.3169	20.3296	20.3296	20.3321	20.3245	20.3169	20.3119	20.3068	(88)
util rest of house	0.8660	0.8078	0.7242	0.6024	0.4637	0.3185	0.2160	0.2348	0.3842	0.6162	0.7988	0.8802	(89)
MIT 2	19.5607	19.7854	20.0110	20.2032	20.2870	20.3255	20.3291	20.3313	20.3147	20.2147	19.9081	19.5268	(90)
Living area fraction									fLA = Living area / (4) =			0.5577	(91)
MIT	20.0028	20.2059	20.4118	20.5861	20.6661	20.6986	20.7027	20.7035	20.6899	20.5941	20.3103	19.9681	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0028	20.2059	20.4118	20.5861	20.6661	20.6986	20.7027	20.7035	20.6899	20.5941	20.3103	19.9681	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8597	0.8053	0.7279	0.6141	0.4810	0.3386	0.2375	0.2569	0.4058	0.6302	0.7988	0.8735	(94)
Useful gains	459.4248	482.7949	470.2352	413.5396	328.1133	222.6165	150.3607	157.0154	241.0563	350.1309	413.9036	445.3754	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	606.4144	588.8201	533.1306	439.1828	335.6333	223.7745	150.5396	157.2701	243.7532	374.1122	498.4183	599.5970	(97)
Space heating kWh	109.3603	71.2489	46.7942	18.4631	5.5949	0.0000	0.0000	0.0000	0.0000	17.8421	60.8505	114.7408	(98a)
Space heating requirement - total per year (kWh/year)												444.8948	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	109.3603	71.2489	46.7942	18.4631	5.5949	0.0000	0.0000	0.0000	0.0000	17.8421	60.8505	114.7408	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												444.8948	
Space heating per m2											(98c) / (4) =	8.6421	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	109.3603	71.2489	46.7942	18.4631	5.5949	0.0000	0.0000	0.0000	0.0000	17.8421	60.8505	114.7408	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	109.3603	71.2489	46.7942	18.4631	5.5949	0.0000	0.0000	0.0000	0.0000	17.8421	60.8505	114.7408	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.2018	10.1177	11.2018	10.8404	11.2018	10.8404	11.2018	11.2018	10.8404	11.2018	10.8404	11.2018	(231)
Lighting	15.7903	12.6676	11.4058	8.3564	6.4547	5.2735	5.8882	7.6537	9.9414	13.0436	14.7327	16.2292	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.5519	-20.0453	-32.6636	-41.1244	-48.2088	-46.3037	-45.5776	-41.0585	-33.4245	-24.4247	-14.4855	-10.5687	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.2154	-5.2703	-11.9487	-20.3624	-28.8759	-29.8558	-29.4243	-23.7899	-16.2296	-8.3732	-3.1703	-1.6909	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	444.8948	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2212.9335	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	131.8918	(230a)
Total electricity for the above, kWh/year	131.8918	(231)
Electricity for lighting (calculated in Appendix L)	127.4370	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-551.6441	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)

Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2365.5130	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	444.8948	16.4900	73.3632	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	16.4900	364.9127	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	131.8918	16.4900	21.7490	(249)
Energy for lighting	127.4370	16.4900	21.0144	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-370.4373	16.4900	-61.0851	
PV Unit electricity exported	-181.2068	5.5900	-10.1295	
Total			-71.2146	(252)
Total energy cost			409.8246	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.5292	(257)
SAP value		75.2117	
SAP rating (Section 12)		75	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	444.8948	0.1575	70.0815	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2212.9335	0.1413	312.5953	(264)
Space and water heating			382.6768	(265)
Pumps, fans and electric keep-hot	131.8918	0.1387	18.2950	(267)
Energy for lighting	127.4370	0.1443	18.3931	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-370.4373	0.1323	-49.0188	
PV Unit electricity exported	-181.2068	0.1228	-22.2609	
Total			-71.2797	(269)
Total CO2, kg/year			348.0853	(272)
CO2 emissions per m2			6.7600	(273)
EI value			95.1655	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.4800	(1b) x	3.0000	(2b) =	154.4400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.4800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		154.4400	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.1800	1.2357	8.8726			(27)
External Wall 1	17.5500	7.1800	10.3700	0.1400	1.4518	14.0000	145.1800	(29a)
External Roof 1	51.4800		51.4800	0.1100	5.6628	9.0000	463.3200	(30)
Total net area of external elements Aum(A, m2)			69.0300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	15.9872			(33)
Party Wall 1			52.8000	0.0000	0.0000	20.0000	1056.0000	(32)
Wall to corridor			17.5500	0.0000	0.0000	20.0000	351.0000	(32)
Party Floor 1			51.4800			80.0000	4118.4000	(32d)
Internal Wall 1			89.1000			9.0000	801.9000	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 6935.8000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 134.7280 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.0900	0.0500	0.1545
E4 Jamb	18.5600	0.0500	0.9280
E7 Party floor between dwellings (in blocks of flats)	5.8500	0.0700	0.4095
E18 Party wall between dwellings	6.0000	0.0600	0.3600
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.4500	0.0000	0.0000
E15 Flat roof with parapet	5.8500	0.5600	3.2760
P4 Party wall - Roof (insulation at ceiling level)	23.4500	0.1200	2.8140

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.9420 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 23.9292 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	14.8372	14.8372	14.5410	13.6523	13.5042	12.9117	12.6155	12.6155	13.2080	13.9485	14.2448	14.0967	(38)
Heat transfer coeff	38.7665	38.7665	38.4702	37.5815	37.4334	36.8409	36.5447	36.5447	37.1372	37.8778	38.1740	38.0259	(39)

Average = Sum(39)m / 12 = 37.6803

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7530	0.7530	0.7473	0.7300	0.7271	0.7156	0.7099	0.7099	0.7214	0.7358	0.7415	0.7387	(40)
HLP (average)												0.7319	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7337 (42)
Hot water usage for mixer showers

73.2716	72.1705	70.5659	67.4959	65.2303	62.7037	61.2676	62.8600	64.6056	67.3184	70.4543	72.9909	(42a)

Hot water usage for baths

23.0390	22.6968	22.2150	21.3266	20.6614	19.9237	19.5253	20.0037	20.5247	21.3140	22.2207	22.9611	(42b)

Hot water usage for other uses

32.3851	31.2075	30.0298	28.8522	27.6746	26.4969	26.4969	27.6746	28.8522	30.0298	31.2075	32.3851	(42c)

Average daily hot water use (litres/day) 118.3558 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.6957	126.0748	122.8108	117.6747	113.5662	109.1243	107.2898	110.5383	113.9825	118.6622	123.8825	128.3371	(44)
Energy conte	203.8226	179.5288	188.7556	161.0907	152.8819	134.1811	129.7577	136.8695	140.5518	161.0235	176.4934	200.9449	(45)

Energy content (annual) Total = Sum(45)m = 1965.9015
Distribution loss (46)m = 0.15 x (45)m

30.5734	26.9293	28.3133	24.1636	22.9323	20.1272	19.4636	20.5304	21.0828	24.1535	26.4740	30.1417	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)

Total per year (kWh/year) = Sum(64)m = 2212.9335 (64)
Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month

84.5557	74.8537	79.5459	69.8059	67.6179	60.8584	59.9291	62.2937	62.9767	70.3250	74.9273	83.5988	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	18.0400	16.0230	13.0308	9.8651	7.3743	6.2257	6.7271	8.7441	11.7363	14.9020	17.3928	18.5414	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	225.4877	227.8276	221.9312	209.3786	193.5331	178.6406	168.6914	166.3516	172.2479	184.8006	200.6461	215.5386	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	(71)

Water heating gains (Table 5)

	113.6501	111.3894	106.9165	96.9526	90.8842	84.5256	80.5498	83.7281	87.4676	94.5228	104.0656	112.3640	(72)

Total internal gains

	438.9885	437.0507	423.6892	398.0070	373.6023	351.2025	337.7790	340.6346	353.2626	376.0361	403.9152	428.2547	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.1800	33.4622	0.6300	0.8270	0.7700	86.7478	(77)

Solar gains	86.7478	157.7089	225.5139	293.9220	325.8839	314.4382	306.9161	273.5144	241.9971	173.2574	106.7816	75.9203	(83)
Total gains	525.7363	594.7595	649.2030	691.9290	699.4862	665.6408	644.6951	614.1490	595.2597	549.2935	510.6969	504.1750	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.6979	49.6979	50.0806	51.2648	51.4677	52.2954	52.7193	52.7193	51.8782	50.8639	50.4692	50.6658	
alpha	4.3132	4.3132	4.3387	4.4177	4.4312	4.4864	4.5146	4.5146	4.4585	4.3909	4.3646	4.3777	
util living area	0.8925	0.8445	0.7737	0.6573	0.5328	0.4260	0.3439	0.3663	0.4987	0.7014	0.8422	0.9042	(86)
MIT	20.2839	20.4635	20.6661	20.8603	20.9520	20.9857	20.9955	20.9940	20.9713	20.8411	20.5562	20.2498	(87)
Th 2	20.2942	20.2942	20.2993	20.3144	20.3169	20.3270	20.3321	20.3321	20.3220	20.3093	20.3043	20.3068	(88)
util rest of house	0.8799	0.8283	0.7527	0.6306	0.5011	0.3908	0.3069	0.3277	0.4606	0.6705	0.8233	0.8928	(89)
MIT 2	19.4738	19.6897	19.9341	20.1700	20.2716	20.3152	20.3289	20.3278	20.2972	20.1492	19.8152	19.4424	(90)
Living area fraction										fLA = Living area / (4) =		0.5577	(91)
MIT	19.9256	20.1212	20.3424	20.5549	20.6511	20.6892	20.7006	20.6993	20.6731	20.5350	20.2285	19.8927	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9256	20.1212	20.3424	20.5549	20.6511	20.6892	20.7006	20.6993	20.6731	20.5350	20.2285	19.8927	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8728	0.8241	0.7541	0.6401	0.5168	0.4098	0.3274	0.3490	0.4805	0.6808	0.8211	0.8853	(94)
Useful gains	458.8380	490.1147	489.5368	442.9287	361.4704	272.7757	211.0417	214.3462	286.0034	373.9849	419.3104	446.3704	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	621.2547	613.3336	567.1422	475.5918	372.5036	275.9079	211.9820	215.5897	292.3859	410.4074	520.2528	615.7404	(97)
Space heating kWh	120.8380	82.8032	57.7385	23.5175	8.2087	0.0000	0.0000	0.0000	0.0000	27.0983	72.6785	126.0113	(98a)
Space heating requirement - total per year (kWh/year)												518.8939	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	120.8380	82.8032	57.7385	23.5175	8.2087	0.0000	0.0000	0.0000	0.0000	27.0983	72.6785	126.0113	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												518.8939	
Space heating per m2											(98c) / (4) =	10.0795	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	120.8380	82.8032	57.7385	23.5175	8.2087	0.0000	0.0000	0.0000	0.0000	27.0983	72.6785	126.0113	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	120.8380	82.8032	57.7385	23.5175	8.2087	0.0000	0.0000	0.0000	0.0000	27.0983	72.6785	126.0113	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													

	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.2018	10.1177	11.2018	10.8404	11.2018	10.8404	11.2018	11.2018	10.8404	11.2018	10.8404	11.2018	(231)
Lighting	15.7903	12.6676	11.4058	8.3564	6.4547	5.2735	5.8882	7.6537	9.9414	13.0436	14.7327	16.2292	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.3683	-19.3194	-32.7760	-43.0132	-50.0269	-46.9880	-46.6511	-41.0712	-33.2014	-23.4678	-13.4823	-9.7672	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.8671	-4.8804	-11.8210	-21.8370	-30.7287	-30.6874	-30.7366	-23.8034	-16.0377	-7.6964	-2.7758	-1.4732	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	518.8939	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2212.9335	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	131.8918	(230a)
Total electricity for the above, kWh/year	131.8918	(231)
Electricity for lighting (calculated in Appendix L)	127.4370	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-555.4776	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2435.6786	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	518.8939	25.1600	130.5537	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	25.1600	556.7741	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	131.8918	25.1600	33.1840	(249)
Energy for lighting	127.4370	25.1600	32.0632	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-371.1328	25.1600	-93.3770	
PV Unit electricity exported	-184.3448	5.8100	-10.7104	
Total			-104.0874	(252)
Total energy cost			648.4875	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	518.8939	0.1569	81.4253	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2212.9335	0.1413	312.5953	(264)
Space and water heating			394.0206	(265)
Pumps, fans and electric keep-hot	131.8918	0.1387	18.2950	(267)
Energy for lighting	127.4370	0.1443	18.3931	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-371.1328	0.1320	-49.0002	
PV Unit electricity exported	-184.3448	0.1223	-22.5469	
Total			-71.5471	(269)
Total CO2, kg/year			359.1616	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	518.8939	1.5809	820.3210	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	1.5223	3368.8373	(278)
Space and water heating			4189.1583	(279)
Pumps, fans and electric keep-hot	131.8918	1.5128	199.5259	(281)
Energy for lighting	127.4370	1.5338	195.4672	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-371.1328	1.4878	-552.1786	
PV Unit electricity exported	-184.3448	0.4488	-82.7401	
Total			-634.9187	(283)
Total Primary energy kWh/year			3949.2326	(286)

SAP 10 EPC IMPROVEMENTS

Unit 216 L08_Copy

Current energy efficiency rating: C 75
Current environmental impact rating: A 95

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Typical annual savings — Energy efficiency — Environmental impact

Recommended measures
(none)

Total Savings £0 0.00 kg/m²

Potential energy efficiency rating: C 75
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£753	£753	£0
Space heating	£164	£164	£0
Water heating	£557	£557	£0
Lighting	£32	£32	£0
Generated (PV)	-£104	-£104	£0
Total cost of fuels	£649	£649	£0
Total cost of uses	£649	£649	£0
Delivered energy	47 kWh/m²	47 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	7 kg/m²	7 kg/m²	0 kg/m²
Primary energy	77 kWh/m²	77 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.4800 (1b)	x	3.0000 (2b)	=	154.4400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.4800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	154.4400	(5)

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2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.1800	1.2357	8.8726			(27)
External Wall 1	17.5500	7.1800	10.3700	0.1400	1.4518	14.0000	145.1800	(29a)
External Roof 1	51.4800		51.4800	0.1100	5.6628	9.0000	463.3200	(30)
Total net area of external elements Aum(A, m2)			69.0300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		15.9872			(33)
Party Wall 1			52.8000	0.0000	0.0000	20.0000	1056.0000	(32)
Wall to corridor			17.5500	0.0000	0.0000	20.0000	351.0000	(32)
Party Floor 1			51.4800			80.0000	4118.4000	(32d)
Internal Wall 1			89.1000			9.0000	801.9000	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 6935.8000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 134.7280 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	3.0900	0.0500	0.1545
E4 Jamb	18.5600	0.0500	0.9280
E7 Party floor between dwellings (in blocks of flats)	5.8500	0.0700	0.4095
E18 Party wall between dwellings	6.0000	0.0600	0.3600
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.4500	0.0000	0.0000
E15 Flat roof with parapet	5.8500	0.5600	3.2760
P4 Party wall - Roof (insulation at ceiling level)	23.4500	0.1200	2.8140

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.9420 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 23.9292 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	14.6891	14.5410	14.3929	13.6523	13.5042	12.7636	12.7636	12.6155	13.0598	13.5042	13.8004	14.0967	(38)
Heat transfer coeff	38.6183	38.4702	38.3221	37.5815	37.4334	36.6928	36.6928	36.5447	36.9891	37.4334	37.7296	38.0259	(39)

Average = Sum(39)m / 12 = 37.5445

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7502	0.7473	0.7444	0.7300	0.7271	0.7128	0.7128	0.7099	0.7185	0.7271	0.7329	0.7387	(40)
HLP (average)												0.7293	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7337 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.2716	72.1705	70.5659	67.4959	65.2303	62.7037	61.2676	62.8600	64.6056	67.3184	70.4543	72.9909	(42a)
Hot water usage for baths	23.0390	22.6968	22.2150	21.3266	20.6614	19.9237	19.5253	20.0037	20.5247	21.3140	22.2207	22.9611	(42b)
Hot water usage for other uses	32.3851	31.2075	30.0298	28.8522	27.6746	26.4969	26.4969	27.6746	28.8522	30.0298	31.2075	32.3851	(42c)

Average daily hot water use (litres/day) 118.3558 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.6957	126.0748	122.8108	117.6747	113.5662	109.1243	107.2898	110.5383	113.9825	118.6622	123.8825	128.3371	(44)
Energy conte	203.8226	179.5288	188.7556	161.0907	152.8819	134.1811	129.7577	136.8695	140.5518	161.0235	176.4934	200.9449	(45)
Energy content (annual)										Total = Sum(45)m =		1965.9015	
Distribution loss (46)m = 0.15 x (45)m	30.5734	26.9293	28.3133	24.1636	22.9323	20.1272	19.4636	20.5304	21.0828	24.1535	26.4740	30.1417	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
									Total per year (kWh/year) = Sum(64)m =			2212.9335	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	84.5557	74.8537	79.5459	69.8059	67.6179	60.8584	59.9291	62.2937	62.9767	70.3250	74.9273	83.5988	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.0400	16.0230	13.0308	9.8651	7.3743	6.2257	6.7271	8.7441	11.7363	14.9020	17.3928	18.5414	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	225.4877	227.8276	221.9312	209.3786	193.5331	178.6406	168.6914	166.3516	172.2479	184.8006	200.6461	215.5386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	(71)
Water heating gains (Table 5)	113.6501	111.3894	106.9165	96.9526	90.8842	84.5256	80.5498	83.7281	87.4676	94.5228	104.0656	112.3640	(72)
Total internal gains													

	438.9885	437.0507	423.6892	398.0070	373.6023	351.2025	337.7790	340.6346	353.2626	376.0361	403.9152	428.2547 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.1800	36.7938	0.6300	0.8270	0.7700	95.3847	(77)

Solar gains	95.3847	162.4755	222.3060	275.4479	308.5246	306.2935	295.2996	270.6229	240.7104	179.5700	114.2489	81.6294 (83)
Total gains	534.3732	599.5261	645.9952	673.4549	682.1269	657.4960	633.0787	611.2575	593.9730	555.6061	518.1641	509.8842 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.8885	50.0806	50.2741	51.2648	51.4677	52.5065	52.5065	52.7193	52.0860	51.4677	51.0636	50.6658	
alpha	4.3259	4.3387	4.3516	4.4177	4.4312	4.5004	4.5004	4.5146	4.4724	4.4312	4.4042	4.3777	
util living area	0.8799	0.8257	0.7473	0.6313	0.4973	0.3549	0.2546	0.2744	0.4240	0.6500	0.8198	0.8929	(86)
MIT	20.3533	20.5394	20.7297	20.8898	20.9669	20.9945	20.9990	20.9987	20.9874	20.8949	20.6292	20.3182	(87)
Th 2	20.2967	20.2993	20.3018	20.3144	20.3169	20.3296	20.3296	20.3321	20.3245	20.3169	20.3119	20.3068	(88)
util rest of house	0.8660	0.8078	0.7242	0.6024	0.4637	0.3185	0.2160	0.2348	0.3842	0.6162	0.7988	0.8802	(89)
MIT 2	19.5607	19.7854	20.0110	20.2032	20.2870	20.3255	20.3291	20.3313	20.3147	20.2147	19.9081	19.5268	(90)
Living area fraction										fLA = Living area / (4) =		0.5577	(91)
MIT	20.0028	20.2059	20.4118	20.5861	20.6661	20.6986	20.7027	20.7035	20.6899	20.5941	20.3103	19.9681	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0028	20.2059	20.4118	20.5861	20.6661	20.6986	20.7027	20.7035	20.6899	20.5941	20.3103	19.9681	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8597	0.8053	0.7279	0.6141	0.4810	0.3386	0.2375	0.2569	0.4058	0.6302	0.7988	0.8735	(94)
Useful gains	459.4248	482.7949	470.2352	413.5396	328.1133	222.6165	150.3607	157.0154	241.0563	350.1309	413.9036	445.3754	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	606.4144	588.8201	533.1306	439.1828	335.6333	223.7745	150.5396	157.2701	243.7532	374.1122	498.4183	599.5970	(97)
Space heating kWh	109.3603	71.2489	46.7942	18.4631	5.5949	0.0000	0.0000	0.0000	0.0000	17.8421	60.8505	114.7408	(98a)
Space heating requirement - total per year (kWh/year)												444.8948	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	109.3603	71.2489	46.7942	18.4631	5.5949	0.0000	0.0000	0.0000	0.0000	17.8421	60.8505	114.7408	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												444.8948	
Space heating per m2											(98c) / (4) =	8.6421	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	109.3603	71.2489	46.7942	18.4631	5.5949	0.0000	0.0000	0.0000	0.0000	17.8421	60.8505	114.7408	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	109.3603	71.2489	46.7942	18.4631	5.5949	0.0000	0.0000	0.0000	0.0000	17.8421	60.8505	114.7408	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.2018	10.1177	11.2018	10.8404	11.2018	10.8404	11.2018	11.2018	10.8404	11.2018	10.8404	11.2018	(231)
Lighting	15.7903	12.6676	11.4058	8.3564	6.4547	5.2735	5.8882	7.6537	9.9414	13.0436	14.7327	16.2292	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.5519	-20.0453	-32.6636	-41.1244	-48.2088	-46.3037	-45.5776	-41.0585	-33.4245	-24.4247	-14.4855	-10.5687	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.2154	-5.2703	-11.9487	-20.3624	-28.8759	-29.8558	-29.4243	-23.7899	-16.2296	-8.3732	-3.1703	-1.6909	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity)

(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	444.8948 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2212.9335 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	131.8918 (230a)
Total electricity for the above, kWh/year	131.8918 (231)
Electricity for lighting (calculated in Appendix L)	127.4370 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-551.6441 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2365.5130 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	444.8948	16.4900	73.3632	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	16.4900	364.9127	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	131.8918	16.4900	21.7490	(249)
Energy for lighting	127.4370	16.4900	21.0144	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-370.4373	16.4900	-61.0851	
PV Unit electricity exported	-181.2068	5.5900	-10.1295	
Total			-71.2146	(252)
Total energy cost			409.8246	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.5292 (257)
SAP value		75.2117
SAP rating (Section 12)		75 (258)
SAP band		C

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	444.8948	0.1575	70.0815	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2212.9335	0.1413	312.5953	(264)
Space and water heating			382.6768	(265)
Pumps, fans and electric keep-hot	131.8918	0.1387	18.2950	(267)
Energy for lighting	127.4370	0.1443	18.3931	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-370.4373	0.1323	-49.0188	
PV Unit electricity exported	-181.2068	0.1228	-22.2609	
Total			-71.2797	(269)
Total CO2, kg/year			348.0853	(272)
CO2 emissions per m2			6.7600	(273)
EI value			95.1655	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		51.4800 (1b)	x	3.0000 (2b)	=	154.4400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.4800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		154.4400	(5)

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2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.1800	1.2357	8.8726			(27)
External Wall 1	17.5500	7.1800	10.3700	0.1400	1.4518	14.0000	145.1800	(29a)
External Roof 1	51.4800		51.4800	0.1100	5.6628	9.0000	463.3200	(30)
Total net area of external elements Aum(A, m2)			69.0300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		15.9872			(33)
Party Wall 1			52.8000	0.0000	0.0000	20.0000	1056.0000	(32)
Wall to corridor			17.5500	0.0000	0.0000	20.0000	351.0000	(32)
Party Floor 1			51.4800			80.0000	4118.4000	(32d)
Internal Wall 1			89.1000			9.0000	801.9000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	6935.8000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		134.7280 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.0900	0.0500	0.1545
E4 Jamb	18.5600	0.0500	0.9280
E7 Party floor between dwellings (in blocks of flats)	5.8500	0.0700	0.4095
E18 Party wall between dwellings	6.0000	0.0600	0.3600
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.4500	0.0000	0.0000
E15 Flat roof with parapet	5.8500	0.5600	3.2760
P4 Party wall - Roof (insulation at ceiling level)	23.4500	0.1200	2.8140

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		7.9420 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	23.9292 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	14.8372	14.8372	14.5410	13.6523	13.5042	12.9117	12.6155	12.6155	13.2080	13.9485	14.2448	14.0967	(38)
Heat transfer coeff	38.7665	38.7665	38.4702	37.5815	37.4334	36.8409	36.5447	36.5447	37.1372	37.8778	38.1740	38.0259	(39)
Average = Sum(39)m / 12 =												37.6803	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7530	0.7530	0.7473	0.7300	0.7271	0.7156	0.7099	0.7099	0.7214	0.7358	0.7415	0.7387	(40)
HLP (average)												0.7319	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.7337 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.2716	72.1705	70.5659	67.4959	65.2303	62.7037	61.2676	62.8600	64.6056	67.3184	70.4543	72.9909	(42a)

Hot water usage for baths

23.0390	22.6968	22.2150	21.3266	20.6614	19.9237	19.5253	20.0037	20.5247	21.3140	22.2207	22.9611	(42b)

Hot water usage for other uses

32.3851	31.2075	30.0298	28.8522	27.6746	26.4969	26.4969	27.6746	28.8522	30.0298	31.2075	32.3851	(42c)
Average daily hot water use (litres/day)												118.3558 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.6957	126.0748	122.8108	117.6747	113.5662	109.1243	107.2898	110.5383	113.9825	118.6622	123.8825	128.3371	(44)
Energy conte	203.8226	179.5288	188.7556	161.0907	152.8819	134.1811	129.7577	136.8695	140.5518	161.0235	176.4934	200.9449	(45)
Energy content (annual)										Total = Sum(45)m =		1965.9015	
Distribution loss (46)m = 0.15 x (45)m	30.5734	26.9293	28.3133	24.1636	22.9323	20.1272	19.4636	20.5304	21.0828	24.1535	26.4740	30.1417	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

Total storage loss

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)

Total per year (kWh/year) = Sum(64)m = 2212.9335 (64)

Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

	84.5557	74.8537	79.5459	69.8059	67.6179	60.8584	59.9291	62.2937	62.9767	70.3250	74.9273	83.5988	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	18.0400	16.0230	13.0308	9.8651	7.3743	6.2257	6.7271	8.7441	11.7363	14.9020	17.3928	18.5414	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	225.4877	227.8276	221.9312	209.3786	193.5331	178.6406	168.6914	166.3516	172.2479	184.8006	200.6461	215.5386	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	(71)

Water heating gains (Table 5)

	113.6501	111.3894	106.9165	96.9526	90.8842	84.5256	80.5498	83.7281	87.4676	94.5228	104.0656	112.3640	(72)

Total internal gains

	438.9885	437.0507	423.6892	398.0070	373.6023	351.2025	337.7790	340.6346	353.2626	376.0361	403.9152	428.2547	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.1800	33.4622	0.6300	0.8270	0.7700	86.7478	(77)

Solar gains	86.7478	157.7089	225.5139	293.9220	325.8839	314.4382	306.9161	273.5144	241.9971	173.2574	106.7816	75.9203	(83)
Total gains	525.7363	594.7595	649.2030	691.9290	699.4862	665.6408	644.6951	614.1490	595.2597	549.2935	510.6969	504.1750	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.6979	49.6979	50.0806	51.2648	51.4677	52.2954	52.7193	52.7193	51.8782	50.8639	50.4692	50.6658	
alpha	4.3132	4.3132	4.3387	4.4177	4.4312	4.4864	4.5146	4.5146	4.4585	4.3909	4.3646	4.3777	
util living area	0.8925	0.8445	0.7737	0.6573	0.5328	0.4260	0.3439	0.3663	0.4987	0.7014	0.8422	0.9042	(86)
MIT	20.2839	20.4635	20.6661	20.8603	20.9520	20.9857	20.9955	20.9940	20.9713	20.8411	20.5562	20.2498	(87)
Th 2	20.2942	20.2942	20.2993	20.3144	20.3169	20.3270	20.3321	20.3321	20.3220	20.3093	20.3043	20.3068	(88)
util rest of house	0.8799	0.8283	0.7527	0.6306	0.5011	0.3908	0.3069	0.3277	0.4606	0.6705	0.8233	0.8928	(89)
MIT 2	19.4738	19.6897	19.9341	20.1700	20.2716	20.3152	20.3289	20.3278	20.2972	20.1492	19.8152	19.4424	(90)
Living area fraction									fLA = Living area / (4) =			0.5577	(91)
MIT	19.9256	20.1212	20.3424	20.5549	20.6511	20.6892	20.7006	20.6993	20.6731	20.5350	20.2285	19.8927	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9256	20.1212	20.3424	20.5549	20.6511	20.6892	20.7006	20.6993	20.6731	20.5350	20.2285	19.8927	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8728	0.8241	0.7541	0.6401	0.5168	0.4098	0.3274	0.3490	0.4805	0.6808	0.8211	0.8853	(94)
Useful gains	458.8380	490.1147	489.5368	442.9287	361.4704	272.7757	211.0417	214.3462	286.0034	373.9849	419.3104	446.3704	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	621.2547	613.3336	567.1422	475.5918	372.5036	275.9079	211.9820	215.5897	292.3859	410.4074	520.2528	615.7404	(97)
Space heating kWh	120.8380	82.8032	57.7385	23.5175	8.2087	0.0000	0.0000	0.0000	0.0000	27.0983	72.6785	126.0113	(98a)

Space heating requirement - total per year (kWh/year) 518.8939

Solar heating kWh

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)

Solar heating contribution - total per year (kWh/year) 0.0000

Space heating kWh

	120.8380	82.8032	57.7385	23.5175	8.2087	0.0000	0.0000	0.0000	0.0000	27.0983	72.6785	126.0113	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 518.8939

Space heating per m2 (98c) / (4) = 10.0795 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 100.0000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	120.8380	82.8032	57.7385	23.5175	8.2087	0.0000	0.0000	0.0000	0.0000	27.0983	72.6785	126.0113	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	120.8380	82.8032	57.7385	23.5175	8.2087	0.0000	0.0000	0.0000	0.0000	27.0983	72.6785	126.0113	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.2018	10.1177	11.2018	10.8404	11.2018	10.8404	11.2018	11.2018	10.8404	11.2018	10.8404	11.2018	(231)
Lighting	15.7903	12.6676	11.4058	8.3564	6.4547	5.2735	5.8882	7.6537	9.9414	13.0436	14.7327	16.2292	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.3683	-19.3194	-32.7760	-43.0132	-50.0269	-46.9880	-46.6511	-41.0712	-33.2014	-23.4678	-13.4823	-9.7672	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.8671	-4.8804	-11.8210	-21.8370	-30.7287	-30.6874	-30.7366	-23.8034	-16.0377	-7.6964	-2.7758	-1.4732	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1	518.8939	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2212.9335	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	131.8918	(230a)
Total electricity for the above, kWh/year	131.8918	(231)
Electricity for lighting (calculated in Appendix L)	127.4370	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-555.4776	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2435.6786	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	518.8939	25.1600	130.5537	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	25.1600	556.7741	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	131.8918	25.1600	33.1840	(249)
Energy for lighting	127.4370	25.1600	32.0632	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-371.1328	25.1600	-93.3770	
PV Unit electricity exported	-184.3448	5.8100	-10.7104	
Total			-104.0874	(252)
Total energy cost			648.4875	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	518.8939	0.1569	81.4253	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2212.9335	0.1413	312.5953	(264)
Space and water heating			394.0206	(265)
Pumps, fans and electric keep-hot	131.8918	0.1387	18.2950	(267)
Energy for lighting	127.4370	0.1443	18.3931	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-371.1328	0.1320	-49.0002	
PV Unit electricity exported	-184.3448	0.1223	-22.5469	
Total			-71.5471	(269)
Total CO2, kg/year			359.1616	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	518.8939	1.5809	820.3210	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	1.5223	3368.8373	(278)
Space and water heating			4189.1583	(279)
Pumps, fans and electric keep-hot	131.8918	1.5128	199.5259	(281)
Energy for lighting	127.4370	1.5338	195.4672	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-371.1328	1.4878	-552.1786	
PV Unit electricity exported	-184.3448	0.4488	-82.7401	
Total			-634.9187	(283)
Total Primary energy kWh/year			3949.2326	(286)

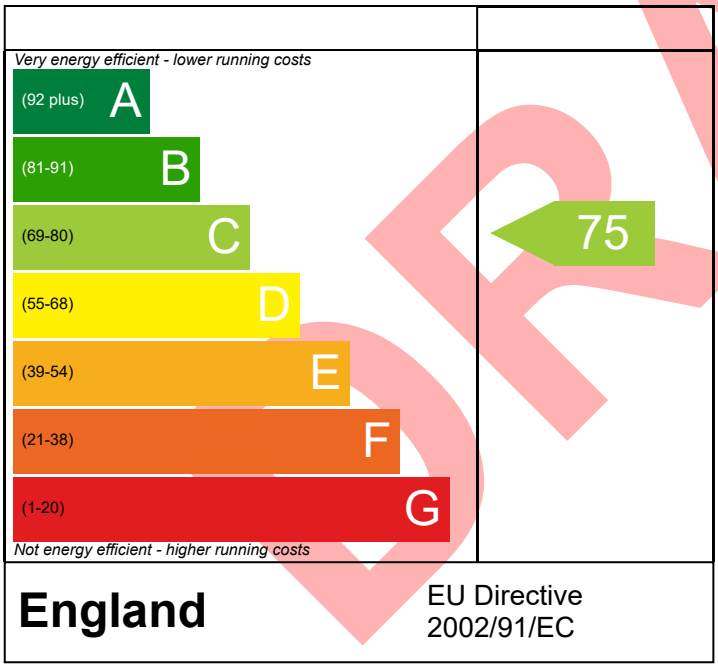
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	51.48 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

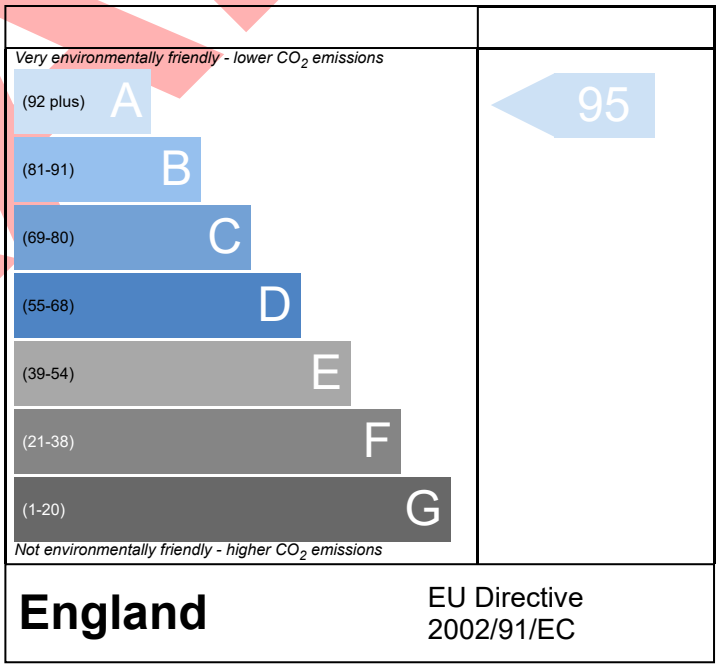
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:42

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	66 m^2
Site Reference	Unit 217 L08_Copy	Plot Reference	Unit 217 L08_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*16.43 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	8.21 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*88.65 kWh_{PE}/m^2*	
Dwelling primary energy	88.73 kWh_{PE}/m^2	FAIL
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*44.9 kWh/m^2*	
Dwelling fabric energy efficiency	42.2 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	27.87	0.14 **(!)**
Party wall: Party Wall (1)	25.2	0 **(!)**
Party wall: Party Wall (2)	24.15	0 **(!)**
Exposed roof: Roof (1)	65.6	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	7.18	North East	0.83	1.3
N, Opening Type 1	3.59	North	0.83	1.3
NW, Opening Type 1	7.18	North West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	
External wall	E15: Flat roof with parapet	Calculated by person with suitable expertise	0.4	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.12	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.85 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 217 L08_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 217 L08_Copy	**Prop Type Ref**	Unit 217 L08
Property			

SAP Rating	68 D	**DER**	8.21	**TER**	16.43
Environmental	94 A	**% DER < TER**			50.03
CO_2 Emissions (t/year)	0.55	**DFEE**	42.24	**TFEE**	44.95
Compliance Check	See BREL	**% DFEE < TFEE**			6.03
% DPER < TPER	-0.09	**DPER**	88.73	**TPER**	88.65

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.6000 (1b)	x	3.0000 (2b)	=	196.8000	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.6000					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	196.8000	(5)

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2. Ventilation rate

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	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			17.9500	1.2357	22.1816			(27)
External Wall 1	45.8200	17.9500	27.8700	0.1400	3.9018	14.0000	390.1800	(29a)
External Roof 1	65.6000		65.6000	0.1100	7.2160	9.0000	590.4000	(30)
Total net area of external elements Aum(A, m2)			111.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.2994			(33)
Party Wall 1			25.2000	0.0000	0.0000	20.0000	504.0000	(32)
Wall to corridor			24.1500	0.0000	0.0000	20.0000	483.0000	(32)
Party Floor 1			65.6000			80.0000	5248.0000	(32d)
Internal Wall 1			141.0000			9.0000	1269.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	8484.5800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		129.3381 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	7.8800	0.0500	0.3940

E4 Jamb	23.2000	0.0500	1.1600		
E7 Party floor between dwellings (in blocks of flats)	15.2700	0.0700	1.0689		
E18 Party wall between dwellings	3.0000	0.0600	0.1800		
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.4500	0.0000	0.0000		
E16 Corner (normal)	6.0000	0.0900	0.5400		
E15 Flat roof with parapet	15.2700	0.4000	6.1080		
P4 Party wall - Roof (insulation at ceiling level)	16.4500	0.1200	1.9740		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				11.4249	(36)
Point Thermal bridges			(36a) =	0.0000	
Total fabric heat loss			(33) + (36) + (36a) =	44.7243	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	19.6496	19.4426	19.2356	18.2006	17.9935	16.9585	16.9585	16.7515	17.3725	17.9935	18.4076	18.8216	(38)
Heat transfer coeff	64.3739	64.1669	63.9599	62.9248	62.7178	61.6828	61.6828	61.4758	62.0968	62.7178	63.1318	63.5458	(39)
Average = Sum(39)m / 12 =												62.8731	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9813	0.9782	0.9750	0.9592	0.9561	0.9403	0.9403	0.9371	0.9466	0.9561	0.9624	0.9687	(40)
HLP (average)												0.9584	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.1348	(42)
Hot water usage for mixer showers	82.5173	81.2772	79.4702	76.0128	73.4613	70.6159	68.9985	70.7919	72.7577	75.8128	79.3445	82.2011	(42a)
Hot water usage for baths	25.9306	25.5455	25.0032	24.0033	23.2545	22.4243	21.9759	22.5144	23.1007	23.9891	25.0096	25.8429	(42b)
Hot water usage for other uses	36.4921	35.1651	33.8381	32.5112	31.1842	29.8572	29.8572	31.1842	32.5112	33.8381	35.1651	36.4921	(42c)
Average daily hot water use (litres/day)												133.2946	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.9400	141.9879	138.3115	132.5272	127.9000	122.8974	120.8316	124.4905	128.3696	133.6401	139.5193	144.5362	(44)
Energy conte	229.5496	202.1888	212.5797	181.4231	172.1780	151.1167	146.1353	154.1452	158.2926	181.3483	198.7708	226.3088	(45)
Energy content (annual)										Total = Sum(45)m =		2214.0368	
Distribution loss (46)m = 0.15 x (45)m	34.4324	30.3283	31.8870	27.2135	25.8267	22.6675	21.9203	23.1218	23.7439	27.2023	29.8156	33.9463	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
										Total per year (kWh/year) = Sum(64)m =		2461.0688	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	93.1099	82.3881	87.4674	76.5664	74.0338	66.4895	65.3746	68.0379	68.8755	77.0830	82.3345	92.0323	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.5047	19.1002	15.5334	11.7598	8.7906	7.4214	8.0190	10.4234	13.9903	17.7639	20.7331	22.1023	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	278.8333	281.7267	274.4354	258.9131	239.3189	220.9031	208.6002	205.7068	212.9981	228.5205	248.1147	266.5304	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	(71)
Water heating gains (Table 5)	125.1477	122.6013	117.5637	106.3422	99.5078	92.3465	87.8691	91.4488	95.6604	103.6061	114.3535	123.6993	(72)
Total internal gains	518.1243	516.0669	500.1711	469.6536	440.2559	413.3096	397.1270	400.2177	415.2875	442.5292	475.8399	504.9707	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5900	10.6334	0.6300	0.8270	0.7700	13.7831	(74)
Northeast	7.1800	11.2829	0.6300	0.8270	0.7700	29.2500	(75)
Northwest	7.1800	11.2829	0.6300	0.8270	0.7700	29.2500	(81)

Solar gains	72.2831	145.4186	259.2999	424.2322	570.4595	608.5987	569.1396	453.3531	315.2363	176.8778	90.6113	59.2643	(83)
Total gains	590.4074	661.4856	759.4710	893.8859	1010.7154	1021.9082	966.2666	853.5708	730.5238	619.4070	566.4512	564.2350	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.6116	36.7297	36.8485	37.4547	37.5783	38.2089	38.2089	38.3375	37.9541	37.5783	37.3318	37.0886	
alpha	3.4408	3.4486	3.4566	3.4970	3.5052	3.5473	3.5473	3.5558	3.5303	3.5052	3.4888	3.4726	
util living area													
	0.9384	0.9104	0.8460	0.7116	0.5383	0.3781	0.2786	0.3269	0.5460	0.7977	0.9105	0.9453	(86)
MIT	19.5513	19.8008	20.2063	20.6492	20.8901	20.9763	20.9939	20.9894	20.9169	20.5568	19.9881	19.5090	(87)
Th 2	20.0989	20.1016	20.1042	20.1175	20.1201	20.1334	20.1334	20.1361	20.1281	20.1201	20.1148	20.1095	(88)
util rest of house													
	0.9291	0.8975	0.8252	0.6785	0.4954	0.3294	0.2247	0.2672	0.4876	0.7635	0.8955	0.9370	(89)
MIT 2	18.4275	18.7381	19.2340	19.7605	20.0216	20.1165	20.1303	20.1303	20.0628	19.6737	18.9864	18.3821	(90)
Living area fraction										fLA = Living area / (4) =		0.4663	(91)
MIT	18.9515	19.2336	19.6874	20.1749	20.4266	20.5174	20.5330	20.5309	20.4611	20.0855	19.4535	18.9076	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9515	19.2336	19.6874	20.1749	20.4266	20.5174	20.5330	20.5309	20.4611	20.0855	19.4535	18.9076	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9147	0.8829	0.8144	0.6807	0.5106	0.3512	0.2497	0.2947	0.5105	0.7621	0.8823	0.9233	(94)
Useful gains	540.0575	584.0051	618.5326	608.5092	516.1192	358.8602	241.2462	251.5485	372.9401	472.0378	499.7764	520.9440	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	943.1756	919.7453	843.4644	709.4718	547.3152	365.0035	242.5984	253.9530	395.0015	594.9093	779.9007	934.6061	(97)
Space heating kWh													
	299.9199	225.6174	167.3492	72.6931	23.2098	0.0000	0.0000	0.0000	0.0000	91.4164	201.6895	307.7646	(98a)
Space heating requirement - total per year (kWh/year)												1389.6600	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	299.9199	225.6174	167.3492	72.6931	23.2098	0.0000	0.0000	0.0000	0.0000	91.4164	201.6895	307.7646	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1389.6600	
Space heating per m2											(98c) / (4) =	21.1838	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	299.9199	225.6174	167.3492	72.6931	23.2098	0.0000	0.0000	0.0000	0.0000	91.4164	201.6895	307.7646	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	299.9199	225.6174	167.3492	72.6931	23.2098	0.0000	0.0000	0.0000	0.0000	91.4164	201.6895	307.7646	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	15.1307	13.6664	15.1307	14.6426	15.1307	14.6426	15.1307	15.1307	14.6426	15.1307	14.6426	15.1307	(231)
Lighting	18.8229	15.1004	13.5963	9.9612	7.6943	6.2863	7.0190	9.1236	11.8506	15.5487	17.5622	19.3460	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.1250	-25.8813	-42.1417	-52.4550	-60.5349	-57.5063	-56.5988	-51.0642	-41.6813	-31.2887	-18.6337	-13.5654	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.6097	-6.2355	-14.4560	-25.5506	-37.2592	-39.1139	-38.5529	-31.2063	-21.3127	-10.3206	-3.7655	-1.9878	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1389.6600	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2461.0688	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)
mechanical ventilation fans (SFP = 0.7420) 178.1512 (230a)

Total electricity for the above, kWh/year	178.1512	(231)
Electricity for lighting (calculated in Appendix L)	151.9116	(232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	-699.8470	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3480.9446	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1389.6600	16.4900	229.1549	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	16.4900	405.8302	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	178.1512	16.4900	29.3771	(249)
Energy for lighting	151.9116	16.4900	25.0502	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-467.4763	16.4900	-77.0868	
PV Unit electricity exported	-232.3707	5.5900	-12.9895	
Total			-90.0764	(252)
Total energy cost			599.3362	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.9508	(257)
SAP value		68.3772	
SAP rating (Section 12)		68	(258)
SAP band		D	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1389.6600	0.1562	217.1023	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2461.0688	0.1413	347.7259	(264)
Space and water heating			564.8283	(265)
Pumps, fans and electric keep-hot	178.1512	0.1387	24.7118	(267)
Energy for lighting	151.9116	0.1443	21.9255	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-467.4763	0.1326	-61.9764	
PV Unit electricity exported	-232.3707	0.1219	-28.3335	
Total			-90.3098	(269)
Total CO2, kg/year			521.1558	(272)
CO2 emissions per m2			7.9400	(273)
EI value			93.6858	
EI rating			94	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		65.6000 (1b)	x	3.0000 (2b)	=	196.8000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.6000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	196.8000	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)

Infiltration rate												0.1500	(18)
Number of sides sheltered												2	(19)
Shelter factor								(20) = 1 - [0.075 x (19)] =				0.8500	(20)
Infiltration rate adjusted to include shelter factor								(21) = (18) x (20) =				0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery		
If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			17.9500	1.2357	22.1816			(27)
External Wall 1	45.8200	17.9500	27.8700	0.1400	3.9018	14.0000	390.1800	(29a)
External Roof 1	65.6000		65.6000	0.1100	7.2160	9.0000	590.4000	(30)
Total net area of external elements Aum(A, m2)			111.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.2994			(33)
Party Wall 1			25.2000	0.0000	0.0000	20.0000	504.0000	(32)
Wall to corridor			24.1500	0.0000	0.0000	20.0000	483.0000	(32)
Party Floor 1			65.6000			80.0000	5248.0000	(32d)
Internal Wall 1			141.0000			9.0000	1269.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 8484.5800	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	129.3381	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	7.8800	0.0500	0.3940
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	15.2700	0.0700	1.0689
E18 Party wall between dwellings	3.0000	0.0600	0.1800
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.4500	0.0000	0.0000
E16 Corner (normal)	6.0000	0.0900	0.5400
E15 Flat roof with parapet	15.2700	0.4000	6.1080
P4 Party wall - Roof (insulation at ceiling level)	16.4500	0.1200	1.9740

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.4249	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	44.7243	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	19.8566	19.8566	19.4426	18.2006	17.9935	17.1655	16.7515	16.7515	17.5795	18.6146	19.0286	18.8216	(38)
Heat transfer coeff	64.5809	64.5809	64.1669	62.9248	62.7178	61.8898	61.4758	61.4758	62.3038	63.3388	63.7529	63.5458	(39)
Average = Sum(39)m / 12 =												63.0628	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9845	0.9845	0.9782	0.9592	0.9561	0.9434	0.9371	0.9371	0.9498	0.9655	0.9718	0.9687	(40)
HLP (average)												0.9613	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1348	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	82.5173	81.2772	79.4702	76.0128	73.4613	70.6159	68.9985	70.7919	72.7577	75.8128	79.3445	82.2011	(42a)
Hot water usage for baths	25.9306	25.5455	25.0032	24.0033	23.2545	22.4243	21.9759	22.5144	23.1007	23.9891	25.0096	25.8429	(42b)
Hot water usage for other uses	36.4921	35.1651	33.8381	32.5112	31.1842	29.8572	29.8572	31.1842	32.5112	33.8381	35.1651	36.4921	(42c)
Average daily hot water use (litres/day)												133.2946	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.9400	141.9879	138.3115	132.5272	127.9000	122.8974	120.8316	124.4905	128.3696	133.6401	139.5193	144.5362	(44)
Energy conte	229.5496	202.1888	212.5797	181.4231	172.1780	151.1167	146.1353	154.1452	158.2926	181.3483	198.7708	226.3088	(45)
Energy content (annual)										Total = Sum(45)m =		2214.0368	
Distribution loss (46)m = 0.15 x (45)m	34.4324	30.3283	31.8870	27.2135	25.8267	22.6675	21.9203	23.1218	23.7439	27.2023	29.8156	33.9463	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
Total per year (kWh/year) = Sum(64)m =												2461.0688	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	93.1099	82.3881	87.4674	76.5664	74.0338	66.4895	65.3746	68.0379	68.8755	77.0830	82.3345	92.0323	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.5047	19.1002	15.5334	11.7598	8.7906	7.4214	8.0190	10.4234	13.9903	17.7639	20.7331	22.1023	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	278.8333	281.7267	274.4354	258.9131	239.3189	220.9031	208.6002	205.7068	212.9981	228.5205	248.1147	266.5304	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	(71)
Water heating gains (Table 5)													
	125.1477	122.6013	117.5637	106.3422	99.5078	92.3465	87.8691	91.4488	95.6604	103.6061	114.3535	123.6993	(72)
Total internal gains													
	518.1243	516.0669	500.1711	469.6536	440.2559	413.3096	397.1270	400.2177	415.2875	442.5292	475.8399	504.9707	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5900	9.5462	0.6300	0.8270	0.7700	12.3738	(74)
Northeast	7.1800	10.0309	0.6300	0.8270	0.7700	26.0043	(75)
Northwest	7.1800	10.0309	0.6300	0.8270	0.7700	26.0043	(81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	64.3824	137.7004	255.9710	441.5733	590.5612	614.0120	580.6227	447.7696	308.5106	166.2493	82.8380	54.0541	(83)
Total gains	582.5066	653.7673	756.1421	911.2269	1030.8171	1027.3216	977.7498	847.9874	723.7981	608.7785	558.6779	559.0248	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.4942	36.4942	36.7297	37.4547	37.5783	38.0811	38.3375	38.3375	37.8280	37.2098	36.9682	37.0886	
alpha	3.4329	3.4329	3.4486	3.4970	3.5052	3.5387	3.5558	3.5558	3.5219	3.4807	3.4645	3.4726	
util living area													
	0.9442	0.9208	0.8659	0.7372	0.5749	0.4521	0.3756	0.4347	0.6291	0.8351	0.9214	0.9507	(86)
MIT	19.4602	19.6763	20.0721	20.5728	20.8504	20.9486	20.9781	20.9646	20.8440	20.4206	19.8754	19.4148	(87)
Th 2	20.0963	20.0963	20.1016	20.1175	20.1201	20.1307	20.1361	20.1361	20.1254	20.1122	20.1069	20.1095	(88)
util rest of house													
	0.9358	0.9094	0.8480	0.7075	0.5353	0.4063	0.3249	0.3786	0.5781	0.8068	0.9083	0.9433	(89)
MIT 2	18.3111	18.5794	19.0684	19.6716	19.9798	20.0889	20.1209	20.1109	19.9887	19.5087	18.8413	18.2633	(90)
Living area fraction										fLA = Living area / (4) =		0.4663	(91)
MIT	18.8469	19.0909	19.5364	20.0918	20.3858	20.4898	20.5207	20.5090	20.3875	19.9339	19.3235	18.8003	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8469	19.0909	19.5364	20.0918	20.3858	20.4898	20.5207	20.5090	20.3875	19.9339	19.3235	18.8003	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9216	0.8945	0.8353	0.7066	0.5475	0.4254	0.3477	0.4032	0.5940	0.8005	0.8945	0.9298	(94)
Useful gains	536.8509	584.7921	631.6277	643.8447	564.4067	437.0706	339.9539	341.8699	429.9144	487.3473	499.7501	519.7796	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	965.2859	955.2106	894.2573	767.1690	607.4710	451.1642	345.5340	350.9647	472.7314	648.2047	811.1613	959.5590	(97)
Space heating kWh													
	318.7556	248.9212	195.3964	88.7935	32.0398	0.0000	0.0000	0.0000	0.0000	119.6779	224.2160	327.1959	(98a)
Space heating requirement - total per year (kWh/year)												1554.9964	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	318.7556	248.9212	195.3964	88.7935	32.0398	0.0000	0.0000	0.0000	0.0000	119.6779	224.2160	327.1959	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1554.9964	
Space heating per m2											(98c) / (4) =	23.7042	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	318.7556	248.9212	195.3964	88.7935	32.0398	0.0000	0.0000	0.0000	0.0000	119.6779	224.2160	327.1959	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	318.7556	248.9212	195.3964	88.7935	32.0398	0.0000	0.0000	0.0000	0.0000	119.6779	224.2160	327.1959	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating
Water heating requirement

	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	15.1307	13.6664	15.1307	14.6426	15.1307	14.6426	15.1307	15.1307	14.6426	15.1307	14.6426	15.1307 (231)
Lighting	18.8229	15.1004	13.5963	9.9612	7.6943	6.2863	7.0190	9.1236	11.8506	15.5487	17.5622	19.3460 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-14.5949	-24.9522	-42.3953	-55.0805	-63.0062	-58.3437	-57.9119	-51.0797	-41.4061	-30.1758	-17.3422	-12.5316 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.1963	-5.7491	-14.1830	-27.1922	-39.4450	-40.1997	-40.2665	-31.2238	-21.0614	-9.3609	-3.2837	-1.7287 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year

Space heating fuel - main system 1	1554.9964 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2461.0688 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	178.1512 (230a)
Total electricity for the above, kWh/year	178.1512 (231)
Electricity for lighting (calculated in Appendix L)	151.9116 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-704.7104 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3641.4176 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1554.9964	25.1600	391.2371	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	25.1600	619.2049	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	178.1512	25.1600	44.8228	(249)
Energy for lighting	151.9116	25.1600	38.2210	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-468.8200	25.1600	-117.9551	
PV Unit electricity exported	-235.8903	5.8100	-13.7052	
Total			-131.6603	(252)
Total energy cost			961.8254	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1554.9964	0.1557	242.0727	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2461.0688	0.1413	347.7259	(264)
Space and water heating			589.7986	(265)
Pumps, fans and electric keep-hot	178.1512	0.1387	24.7118	(267)
Energy for lighting	151.9116	0.1443	21.9255	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-468.8200	0.1323	-62.0183	
PV Unit electricity exported	-235.8903	0.1214	-28.6272	
Total			-90.6455	(269)
Total CO2, kg/year			545.7904	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1554.9964	1.5763	2451.2031	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	1.5225	3746.8812	(278)
Space and water heating			6198.0843	(279)
Pumps, fans and electric keep-hot	178.1512	1.5128	269.5072	(281)
Energy for lighting	151.9116	1.5338	233.0071	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-468.8200	1.4888	-697.9753	
PV Unit electricity exported	-235.8903	0.4453	-105.0340	
Total			-803.0093	(283)
Total Primary energy kWh/year			5897.5893	(286)

SAP 10 EPC IMPROVEMENTS

Unit 217 L08_Copy

Current energy efficiency rating: D 68
Current environmental impact rating: A 94

N Solar water heating	Not applicable
U Solar photovoltaic panels	Not applicable
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: D 68
Potential environmental impact rating: A 94

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£1093	£1093	£0
Space heating	£436	£436	£0
Water heating	£619	£619	£0
Lighting	£38	£38	£0
Generated (PV)	-£132	-£132	£0
Total cost of fuels	£961	£961	£0
Total cost of uses	£961	£961	£0
Delivered energy	56 kWh/m²	56 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.5 tonnes	0.0 tonnes
CO2 emissions per m²	8 kg/m²	8 kg/m²	0 kg/m²
Primary energy	90 kWh/m²	90 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.6000	(1b)	x 3.0000	(2b) =	196.8000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	196.8000	(5)

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2. Ventilation rate
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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			17.9500	1.2357	22.1816			(27)
External Wall 1	45.8200	17.9500	27.8700	0.1400	3.9018	14.0000	390.1800	(29a)
External Roof 1	65.6000		65.6000	0.1100	7.2160	9.0000	590.4000	(30)
Total net area of external elements Aum(A, m2)			111.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.2994			(33)
Party Wall 1			25.2000	0.0000	0.0000	20.0000	504.0000	(32)
Wall to corridor			24.1500	0.0000	0.0000	20.0000	483.0000	(32)
Party Floor 1			65.6000			80.0000	5248.0000	(32d)
Internal Wall 1			141.0000			9.0000	1269.0000	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 8484.5800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 129.3381 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	7.8800	0.0500	0.3940
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	15.2700	0.0700	1.0689
E18 Party wall between dwellings	3.0000	0.0600	0.1800
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.4500	0.0000	0.0000
E16 Corner (normal)	6.0000	0.0900	0.5400
E15 Flat roof with parapet	15.2700	0.4000	6.1080
P4 Party wall - Roof (insulation at ceiling level)	16.4500	0.1200	1.9740

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.4249 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 44.7243 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	19.6496	19.4426	19.2356	18.2006	17.9935	16.9585	16.9585	16.7515	17.3725	17.9935	18.4076	18.8216	(38)
Heat transfer coeff	64.3739	64.1669	63.9599	62.9248	62.7178	61.6828	61.6828	61.4758	62.0968	62.7178	63.1318	63.5458	(39)
Average = Sum(39)m / 12 =												62.8731	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9813	0.9782	0.9750	0.9592	0.9561	0.9403	0.9403	0.9371	0.9466	0.9561	0.9624	0.9687	(40)
HLP (average)												0.9584	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1348 (42)
Hot water usage for mixer showers

82.5173	81.2772	79.4702	76.0128	73.4613	70.6159	68.9985	70.7919	72.7577	75.8128	79.3445	82.2011	(42a)

Hot water usage for baths

25.9306	25.5455	25.0032	24.0033	23.2545	22.4243	21.9759	22.5144	23.1007	23.9891	25.0096	25.8429	(42b)

Hot water usage for other uses

36.4921	35.1651	33.8381	32.5112	31.1842	29.8572	29.8572	31.1842	32.5112	33.8381	35.1651	36.4921	(42c)

Average daily hot water use (litres/day) 133.2946 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.9400	141.9879	138.3115	132.5272	127.9000	122.8974	120.8316	124.4905	128.3696	133.6401	139.5193	144.5362	(44)
Energy conte	229.5496	202.1888	212.5797	181.4231	172.1780	151.1167	146.1353	154.1452	158.2926	181.3483	198.7708	226.3088	(45)
Energy content (annual)										Total = Sum(45)m =		2214.0368	

Distribution loss (46)m = 0.15 x (45)m

34.4324	30.3283	31.8870	27.2135	25.8267	22.6675	21.9203	23.1218	23.7439	27.2023	29.8156	33.9463	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)

Total per year (kWh/year) = Sum(64)m = 2461.0688 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

93.1099	82.3881	87.4674	76.5664	74.0338	66.4895	65.3746	68.0379	68.8755	77.0830	82.3345	92.0323	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.5047	19.1002	15.5334	11.7598	8.7906	7.4214	8.0190	10.4234	13.9903	17.7639	20.7331	22.1023	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	278.8333	281.7267	274.4354	258.9131	239.3189	220.9031	208.6002	205.7068	212.9981	228.5205	248.1147	266.5304	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	(71)
Water heating gains (Table 5)													
	125.1477	122.6013	117.5637	106.3422	99.5078	92.3465	87.8691	91.4488	95.6604	103.6061	114.3535	123.6993	(72)
Total internal gains													
	518.1243	516.0669	500.1711	469.6536	440.2559	413.3096	397.1270	400.2177	415.2875	442.5292	475.8399	504.9707	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5900	10.6334	0.6300	0.8270	0.7700	13.7831	(74)
Northeast	7.1800	11.2829	0.6300	0.8270	0.7700	29.2500	(75)
Northwest	7.1800	11.2829	0.6300	0.8270	0.7700	29.2500	(81)

Solar gains	72.2831	145.4186	259.2999	424.2322	570.4595	608.5987	569.1396	453.3531	315.2363	176.8778	90.6113	59.2643	(83)
Total gains	590.4074	661.4856	759.4710	893.8859	1010.7154	1021.9082	966.2666	853.5708	730.5238	619.4070	566.4512	564.2350	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.6116	36.7297	36.8485	37.4547	37.5783	38.2089	38.2089	38.3375	37.9541	37.5783	37.3318	37.0886	
alpha	3.4408	3.4486	3.4566	3.4970	3.5052	3.5473	3.5473	3.5558	3.5303	3.5052	3.4888	3.4726	
util living area													
	0.9384	0.9104	0.8460	0.7116	0.5383	0.3781	0.2786	0.3269	0.5460	0.7977	0.9105	0.9453	(86)
MIT	19.5513	19.8008	20.2063	20.6492	20.8901	20.9763	20.9939	20.9894	20.9169	20.5568	19.9881	19.5090	(87)
Th 2	20.0989	20.1016	20.1042	20.1175	20.1201	20.1334	20.1334	20.1361	20.1281	20.1201	20.1148	20.1095	(88)
util rest of house													
	0.9291	0.8975	0.8252	0.6785	0.4954	0.3294	0.2247	0.2672	0.4876	0.7635	0.8955	0.9370	(89)
MIT 2	18.4275	18.7381	19.2340	19.7605	20.0216	20.1165	20.1303	20.1303	20.0628	19.6737	18.9864	18.3821	(90)
Living area fraction										fLA = Living area / (4) =		0.4663	(91)
MIT	18.9515	19.2336	19.6874	20.1749	20.4266	20.5174	20.5330	20.5309	20.4611	20.0855	19.4535	18.9076	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9515	19.2336	19.6874	20.1749	20.4266	20.5174	20.5330	20.5309	20.4611	20.0855	19.4535	18.9076	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9147	0.8829	0.8144	0.6807	0.5106	0.3512	0.2497	0.2947	0.5105	0.7621	0.8823	0.9233	(94)
Useful gains	540.0575	584.0051	618.5326	608.5092	516.1192	358.8602	241.2462	251.5485	372.9401	472.0378	499.7764	520.9440	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	943.1756	919.7453	843.4644	709.4718	547.3152	365.0035	242.5984	253.9530	395.0015	594.9093	779.9007	934.6061	(97)
Space heating kWh													
	299.9199	225.6174	167.3492	72.6931	23.2098	0.0000	0.0000	0.0000	0.0000	91.4164	201.6895	307.7646	(98a)
Space heating requirement - total per year (kWh/year)												1389.6600	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	299.9199	225.6174	167.3492	72.6931	23.2098	0.0000	0.0000	0.0000	0.0000	91.4164	201.6895	307.7646	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1389.6600	
Space heating per m2											(98c) / (4) =	21.1838	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	299.9199	225.6174	167.3492	72.6931	23.2098	0.0000	0.0000	0.0000	0.0000	91.4164	201.6895	307.7646	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	299.9199	225.6174	167.3492	72.6931	23.2098	0.0000	0.0000	0.0000	0.0000	91.4164	201.6895	307.7646	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	15.1307	13.6664	15.1307	14.6426	15.1307	14.6426	15.1307	15.1307	14.6426	15.1307	14.6426	15.1307	(231)
Lighting	18.8229	15.1004	13.5963	9.9612	7.6943	6.2863	7.0190	9.1236	11.8506	15.5487	17.5622	19.3460	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.1250	-25.8813	-42.1417	-52.4550	-60.5349	-57.5063	-56.5988	-51.0642	-41.6813	-31.2887	-18.6337	-13.5654	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													

(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.6097	-6.2355	-14.4560	-25.5506	-37.2592	-39.1139	-38.5529	-31.2063	-21.3127	-10.3206	-3.7655	-1.9878	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1389.6600	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2461.0688	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	178.1512	(230a)
Total electricity for the above, kWh/year	178.1512	(231)
Electricity for lighting (calculated in Appendix L)	151.9116	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-699.8470	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3480.9446	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1389.6600	16.4900	229.1549	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	16.4900	405.8302	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	178.1512	16.4900	29.3771	(249)
Energy for lighting	151.9116	16.4900	25.0502	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-467.4763	16.4900	-77.0868	
PV Unit electricity exported	-232.3707	5.5900	-12.9895	
Total			-90.0764	(252)
Total energy cost			599.3362	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.9508	(257)
SAP value		68.3772	
SAP rating (Section 12)		68	(258)
SAP band		D	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1389.6600	0.1562	217.1023	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2461.0688	0.1413	347.7259	(264)
Space and water heating			564.8283	(265)
Pumps, fans and electric keep-hot	178.1512	0.1387	24.7118	(267)
Energy for lighting	151.9116	0.1443	21.9255	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-467.4763	0.1326	-61.9764	
PV Unit electricity exported	-232.3707	0.1219	-28.3335	
Total			-90.3098	(269)
Total CO2, kg/year			521.1558	(272)
CO2 emissions per m2			7.9400	(273)
EI value			93.6858	
EI rating			94	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

Area	Storey height	Volume

	(m2)		(m)		(m3)
Ground floor	65.6000 (1b)	x	3.0000 (2b)	=	196.8000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.6000				(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	196.8000 (5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80	= 0.0000	(6a)
Number of open flues	0 * 20	= 0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10	= 0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20	= 0.0000	(6d)
Number of flues attached to other heater	0 * 35	= 0.0000	(6e)
Number of blocked chimneys	0 * 20	= 0.0000	(6f)
Number of intermittent extract fans	0 * 10	= 0.0000	(7a)
Number of passive vents	0 * 10	= 0.0000	(7b)
Number of flueless gas fires	0 * 40	= 0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5)	= 0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	= 0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	= 0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			17.9500	1.2357	22.1816			(27)
External Wall 1	45.8200	17.9500	27.8700	0.1400	3.9018	14.0000	390.1800	(29a)
External Roof 1	65.6000		65.6000	0.1100	7.2160	9.0000	590.4000	(30)
Total net area of external elements Aum(A, m2)			111.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.2994			(33)
Party Wall 1			25.2000	0.0000	0.0000	20.0000	504.0000	(32)
Wall to corridor			24.1500	0.0000	0.0000	20.0000	483.0000	(32)
Party Floor 1			65.6000			80.0000	5248.0000	(32d)
Internal Wall 1			141.0000			9.0000	1269.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	8484.5800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		129.3381 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	7.8800	0.0500	0.3940
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	15.2700	0.0700	1.0689
E18 Party wall between dwellings	3.0000	0.0600	0.1800
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.4500	0.0000	0.0000
E16 Corner (normal)	6.0000	0.0900	0.5400
E15 Flat roof with parapet	15.2700	0.4000	6.1080
P4 Party wall - Roof (insulation at ceiling level)	16.4500	0.1200	1.9740

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		11.4249 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	44.7243 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	19.8566	19.8566	19.4426	18.2006	17.9935	17.1655	16.7515	16.7515	17.5795	18.6146	19.0286	18.8216	(38)
Heat transfer coeff	64.5809	64.5809	64.1669	62.9248	62.7178	61.8898	61.4758	61.4758	62.3038	63.3388	63.7529	63.5458	(39)
Average = Sum(39)m / 12 =												63.0628	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9845	0.9845	0.9782	0.9592	0.9561	0.9434	0.9371	0.9371	0.9498	0.9655	0.9718	0.9687	(40)
HLP (average)												0.9613	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.1348 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
82.5173	81.2772	79.4702	76.0128	73.4613	70.6159	68.9985	70.7919	72.7577	75.8128	79.3445	82.2011	(42a)

Hot water usage for baths

25.9306	25.5455	25.0032	24.0033	23.2545	22.4243	21.9759	22.5144	23.1007	23.9891	25.0096	25.8429	(42b)

Hot water usage for other uses

36.4921	35.1651	33.8381	32.5112	31.1842	29.8572	29.8572	31.1842	32.5112	33.8381	35.1651	36.4921	(42c)

Average daily hot water use (litres/day)	133.2946 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.9400	141.9879	138.3115	132.5272	127.9000	122.8974	120.8316	124.4905	128.3696	133.6401	139.5193	144.5362	(44)
Energy conte	229.5496	202.1888	212.5797	181.4231	172.1780	151.1167	146.1353	154.1452	158.2926	181.3483	198.7708	226.3088	(45)

Energy content (annual)											Total = Sum(45)m =	2214.0368	
Distribution loss (46)m = 0.15 x (45)m													
	34.4324	30.3283	31.8870	27.2135	25.8267	22.6675	21.9203	23.1218	23.7439	27.2023	29.8156	33.9463	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
										Total per year (kWh/year) = Sum(64)m =		2461.0688	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	93.1099	82.3881	87.4674	76.5664	74.0338	66.4895	65.3746	68.0379	68.8755	77.0830	82.3345	92.0323	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.5047	19.1002	15.5334	11.7598	8.7906	7.4214	8.0190	10.4234	13.9903	17.7639	20.7331	22.1023	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	278.8333	281.7267	274.4354	258.9131	239.3189	220.9031	208.6002	205.7068	212.9981	228.5205	248.1147	266.5304	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	(71)
Water heating gains (Table 5)													
	125.1477	122.6013	117.5637	106.3422	99.5078	92.3465	87.8691	91.4488	95.6604	103.6061	114.3535	123.6993	(72)
Total internal gains													
	518.1243	516.0669	500.1711	469.6536	440.2559	413.3096	397.1270	400.2177	415.2875	442.5292	475.8399	504.9707	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5900	9.5462	0.6300	0.8270	0.7700	12.3738	(74)
Northeast	7.1800	10.0309	0.6300	0.8270	0.7700	26.0043	(75)
Northwest	7.1800	10.0309	0.6300	0.8270	0.7700	26.0043	(81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	64.3824	137.7004	255.9710	441.5733	590.5612	614.0120	580.6227	447.7696	308.5106	166.2493	82.8380	54.0541	(83)
Total gains	582.5066	653.7673	756.1421	911.2269	1030.8171	1027.3216	977.7498	847.9874	723.7981	608.7785	558.6779	559.0248	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.4942	36.4942	36.7297	37.4547	37.5783	38.0811	38.3375	38.3375	37.8280	37.2098	36.9682	37.0886	
alpha	3.4329	3.4329	3.4486	3.4970	3.5052	3.5387	3.5558	3.5558	3.5219	3.4807	3.4645	3.4726	
util living area													
	0.9442	0.9208	0.8659	0.7372	0.5749	0.4521	0.3756	0.4347	0.6291	0.8351	0.9214	0.9507	(86)
MIT	19.4602	19.6763	20.0721	20.5728	20.8504	20.9486	20.9781	20.9646	20.8440	20.4206	19.8754	19.4148	(87)
Th 2	20.0963	20.0963	20.1016	20.1175	20.1201	20.1307	20.1361	20.1361	20.1254	20.1122	20.1069	20.1095	(88)
util rest of house													
	0.9358	0.9094	0.8480	0.7075	0.5353	0.4063	0.3249	0.3786	0.5781	0.8068	0.9083	0.9433	(89)
MIT 2	18.3111	18.5794	19.0684	19.6716	19.9798	20.0889	20.1209	20.1109	19.9887	19.5087	18.8413	18.2633	(90)
Living area fraction										fLA = Living area / (4) =		0.4663	(91)
MIT	18.8469	19.0909	19.5364	20.0918	20.3858	20.4898	20.5207	20.5090	20.3875	19.9339	19.3235	18.8003	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8469	19.0909	19.5364	20.0918	20.3858	20.4898	20.5207	20.5090	20.3875	19.9339	19.3235	18.8003	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9216	0.8945	0.8353	0.7066	0.5475	0.4254	0.3477	0.4032	0.5940	0.8005	0.8945	0.9298	(94)
Useful gains	536.8509	584.7921	631.6277	643.8447	564.4067	437.0706	339.9539	341.8699	429.9144	487.3473	499.7501	519.7796	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	965.2859	955.2106	894.2573	767.1690	607.4710	451.1642	345.5340	350.9647	472.7314	648.2047	811.1613	959.5590	(97)
Space heating kWh													
	318.7556	248.9212	195.3964	88.7935	32.0398	0.0000	0.0000	0.0000	0.0000	119.6779	224.2160	327.1959	(98a)
Space heating requirement - total per year (kWh/year)												1554.9964	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	318.7556	248.9212	195.3964	88.7935	32.0398	0.0000	0.0000	0.0000	0.0000	119.6779	224.2160	327.1959	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 1554.9964
Space heating per m2 (98c) / (4) = 23.7042 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 100.0000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	318.7556	248.9212	195.3964	88.7935	32.0398	0.0000	0.0000	0.0000	0.0000	119.6779	224.2160	327.1959	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	318.7556	248.9212	195.3964	88.7935	32.0398	0.0000	0.0000	0.0000	0.0000	119.6779	224.2160	327.1959	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	15.1307	13.6664	15.1307	14.6426	15.1307	14.6426	15.1307	15.1307	14.6426	15.1307	14.6426	15.1307	(231)
Lighting	18.8229	15.1004	13.5963	9.9612	7.6943	6.2863	7.0190	9.1236	11.8506	15.5487	17.5622	19.3460	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.5949	-24.9522	-42.3953	-55.0805	-63.0062	-58.3437	-57.9119	-51.0797	-41.4061	-30.1758	-17.3422	-12.5316	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.1963	-5.7491	-14.1830	-27.1922	-39.4450	-40.1997	-40.2665	-31.2238	-21.0614	-9.3609	-3.2837	-1.7287	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year
Space heating fuel - main system 1 1554.9964 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 100.0000
Water heating fuel used 2461.0688 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)
mechanical ventilation fans (SFP = 0.7420) 178.1512 (230a)
Total electricity for the above, kWh/year 178.1512 (231)
Electricity for lighting (calculated in Appendix L) 151.9116 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation -704.7104 (233)
Wind generation 0.0000 (234)
Hydro-electric generation (Appendix N) 0.0000 (235a)
Electricity generated - Micro CHP (Appendix N) 0.0000 (235)
Appendix Q - special features
Energy saved or generated -0.0000 (236)
Energy used 0.0000 (237)
Total delivered energy for all uses 3641.4176 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1554.9964	25.1600	391.2371	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	25.1600	619.2049	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	178.1512	25.1600	44.8228	(249)
Energy for lighting	151.9116	25.1600	38.2210	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-468.8200	25.1600	-117.9551	
PV Unit electricity exported	-235.8903	5.8100	-13.7052	
Total			-131.6603	(252)
Total energy cost			961.8254	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1554.9964	0.1557	242.0727	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2461.0688	0.1413	347.7259	(264)
Space and water heating			589.7986	(265)

Pumps, fans and electric keep-hot	178.1512	0.1387	24.7118	(267)
Energy for lighting	151.9116	0.1443	21.9255	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-468.8200	0.1323	-62.0183	
PV Unit electricity exported	-235.8903	0.1214	-28.6272	
Total			-90.6455	(269)
Total CO2, kg/year			545.7904	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1554.9964	1.5763	2451.2031	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	1.5225	3746.8812	(278)
Space and water heating			6198.0843	(279)
Pumps, fans and electric keep-hot	178.1512	1.5128	269.5072	(281)
Energy for lighting	151.9116	1.5338	233.0071	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-468.8200	1.4888	-697.9753	
PV Unit electricity exported	-235.8903	0.4453	-105.0340	
Total			-803.0093	(283)
Total Primary energy kWh/year			5897.5893	(286)

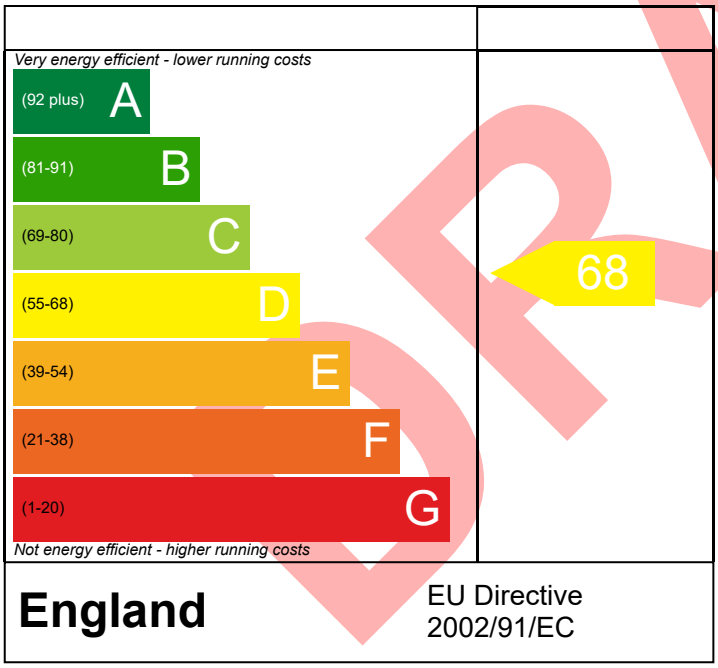
Predicted Energy Assessment

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	65.6 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

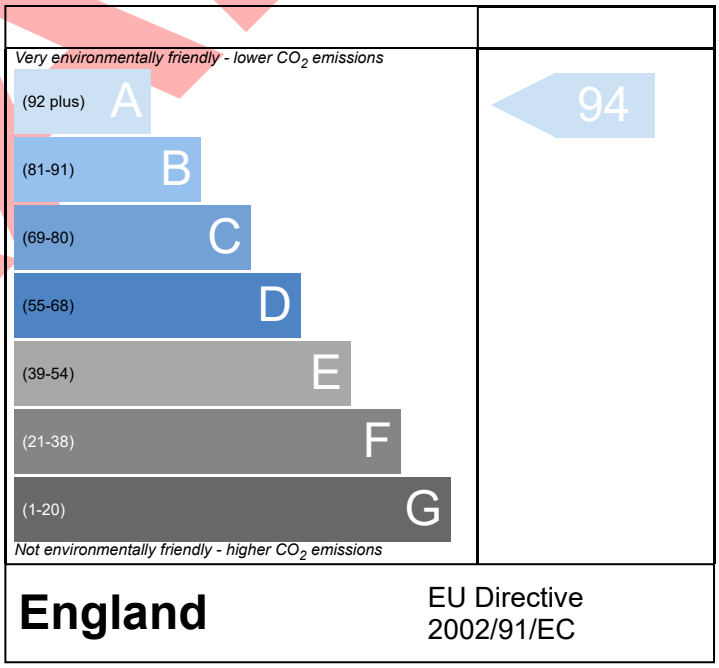
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:43

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	71 m^2
Site Reference	Unit 218 L08_Copy	Plot Reference	Unit 218 L08_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*14.13 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	6.71 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*76.27 kWh_{PE}/m^2*	
Dwelling primary energy	73.45 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*35.3 kWh/m^2*	
Dwelling fabric energy efficiency	33.8 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	14.58	0.14 **(!)**
Party wall: Party Wall (1)	58.47	0 **(!)**
Party wall: Party Wall (2)	17.28	0 **(!)**
Exposed roof: Roof (1)	70.98	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	10.77	North East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E15: Flat roof with parapet	Calculated by person with suitable expertise	0.56	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.12	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.92 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 218 L08_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 218 L08_Copy	**Prop Type Ref**	Unit 218 L08
Property			

SAP Rating	73 C	**DER**	6.71	**TER**	14.13
Environmental	95 A	**% DER < TER**			52.51
CO_2 Emissions (t/year)	0.48	**DFEE**	33.84	**TFEE**	35.32
Compliance Check	See BREL	**% DFEE < TFEE**			4.20
% DPER < TPER	3.69	**DPER**	73.45	**TPER**	76.27

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.9800 (1b)	x	3.0000 (2b)	=	212.9400	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	212.9400	(5)

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2. Ventilation rate

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	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												72.0000	(23c)
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.7700	1.2357	13.3089			(27)
External Wall 1	25.3500	10.7700	14.5800	0.1400	2.0412	14.0000	204.1200	(29a)
External Roof 1	70.9800		70.9800	0.1100	7.8078	9.0000	638.8200	(30)
Total net area of external elements Aum(A, m2)			96.3300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	23.1579			(33)
Party Wall 1			58.4700	0.0000	0.0000	20.0000	1169.4000	(32)
Wall to corridor			17.2800	0.0000	0.0000	20.0000	345.6000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Internal Wall 1			153.9000			9.0000	1385.1000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9421.4400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		132.7337 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	4.6400	0.0500	0.2320

E4 Jamb	27.8400	0.0500	1.3920	
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915	
E18 Party wall between dwellings	6.0000	0.0600	0.3600	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000	
E15 Flat roof with parapet	8.4500	0.5600	4.7320	
P4 Party wall - Roof (insulation at ceiling level)	25.2500	0.1200	3.0300	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				10.3375 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	33.4954 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	20.2532	20.0490	19.8447	18.8236	18.6194	17.5983	17.5983	17.3941	18.0067	18.6194	19.0279	19.4363	(38)
Heat transfer coeff	53.7486	53.5444	53.3402	52.3191	52.1148	51.0937	51.0937	50.8895	51.5022	52.1148	52.5233	52.9317	(39)
Average = Sum(39)m / 12 =												52.2680	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7572	0.7544	0.7515	0.7371	0.7342	0.7198	0.7198	0.7170	0.7256	0.7342	0.7400	0.7457	(40)
HLP (average)												0.7364	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2697	(42)
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)
Average daily hot water use (litres/day)												138.3203	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
										Total per year (kWh/year) = Sum(64)m =		2544.5466	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.4790	20.8538	16.9595	12.8394	9.5976	8.1027	8.7553	11.3804	15.2748	19.3948	22.6366	24.1315	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.6468	544.4702	527.5591	495.2123	463.9464	435.3471	418.2106	421.4595	437.5134	466.4610	501.7873	532.6536	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.7700	11.2829	0.6300	0.8270	0.7700	43.8750	(75)

Solar gains	43.8750	89.3089	160.9062	264.2542	355.2095	378.6909	354.2576	282.4182	196.0667	109.1425	55.2061	35.8305	(83)
Total gains	590.5219	633.7791	688.4652	759.4665	819.1559	814.0379	772.4682	703.8778	633.5801	575.6035	556.9934	568.4842	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.6909	48.8766	49.0637	50.0213	50.2173	51.2209	51.2209	51.4265	50.8147	50.2173	49.8268	49.4423	
alpha	4.2461	4.2584	4.2709	4.3348	4.3478	4.4147	4.4147	4.4284	4.3876	4.3478	4.3218	4.2962	
util living area													
	0.9350	0.9109	0.8542	0.7321	0.5654	0.3974	0.2901	0.3309	0.5405	0.7878	0.9035	0.9418	(86)
MIT	20.0643	20.2280	20.4972	20.7900	20.9413	20.9904	20.9981	20.9967	20.9647	20.7584	20.3822	20.0380	(87)
Th 2	20.2905	20.2931	20.2956	20.3082	20.3107	20.3233	20.3233	20.3259	20.3183	20.3107	20.3057	20.3006	(88)
util rest of house													
	0.9261	0.8992	0.8362	0.7040	0.5290	0.3567	0.2459	0.2831	0.4926	0.7573	0.8892	0.9338	(89)
MIT 2	19.2042	19.4084	19.7380	20.0907	20.2566	20.3161	20.3223	20.3240	20.2897	20.0650	19.6125	19.1795	(90)
Living area fraction										fLA = Living area / (4) =		0.4060	(91)
MIT	19.5535	19.7412	20.0463	20.3747	20.5346	20.5899	20.5967	20.5971	20.5637	20.3465	19.9250	19.5281	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5535	19.7412	20.0463	20.3747	20.5346	20.5899	20.5967	20.5971	20.5637	20.3465	19.9250	19.5281	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9154	0.8889	0.8293	0.7068	0.5410	0.3728	0.2638	0.3024	0.5101	0.7589	0.8804	0.9234	(94)
Useful gains	540.5798	563.3894	570.9652	536.8287	443.1543	303.4901	203.7839	212.8317	323.2127	436.8519	490.3625	524.9557	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	819.8528	794.6643	722.5594	600.3431	460.4157	306.0460	204.2067	213.5897	332.8971	507.9370	673.6135	811.3419	(97)
Space heating kWh													
	207.7791	155.4168	112.7861	45.7304	12.8425	0.0000	0.0000	0.0000	0.0000	52.8874	131.9407	213.0713	(98a)
Space heating requirement - total per year (kWh/year)												932.4542	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	207.7791	155.4168	112.7861	45.7304	12.8425	0.0000	0.0000	0.0000	0.0000	52.8874	131.9407	213.0713	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												932.4542	
Space heating per m2											(98c) / (4) =	13.1369	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	207.7791	155.4168	112.7861	45.7304	12.8425	0.0000	0.0000	0.0000	0.0000	52.8874	131.9407	213.0713	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	207.7791	155.4168	112.7861	45.7304	12.8425	0.0000	0.0000	0.0000	0.0000	52.8874	131.9407	213.0713	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	16.3716	14.7872	16.3716	15.8434	16.3716	15.8434	16.3716	16.3716	15.8434	16.3716	15.8434	16.3716	(231)
Lighting	20.5510	16.4868	14.8445	10.8757	8.4007	6.8635	7.6634	9.9612	12.9386	16.9762	19.1746	21.1222	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-17.2251	-27.5333	-44.7261	-55.7351	-64.6285	-61.7507	-60.7753	-54.8660	-44.8311	-33.2957	-19.8659	-14.5024	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.0524	-7.2284	-16.5326	-28.6945	-41.2192	-42.8265	-42.2124	-34.1796	-23.3507	-11.7403	-4.3780	-2.3317	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												932.4542	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2544.5466	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)													
mechanical ventilation fans (SFP = 0.7420)												192.7618	(230a)
Total electricity for the above, kWh/year												192.7618	(231)
Electricity for lighting (calculated in Appendix L)												165.8585	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-757.4814	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)

Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3078.1397	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	932.4542	16.4900	153.7617	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	16.4900	419.5957	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	192.7618	16.4900	31.7864	(249)
Energy for lighting	165.8585	16.4900	27.3501	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-499.7352	16.4900	-82.4063	
PV Unit electricity exported	-257.7462	5.5900	-14.4080	
Total			-96.8143	(252)
Total energy cost			535.6796	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.6627	(257)
SAP value		73.0470	
SAP rating (Section 12)		73	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	932.4542	0.1567	146.0720	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			505.6165	(265)
Pumps, fans and electric keep-hot	192.7618	0.1387	26.7384	(267)
Energy for lighting	165.8585	0.1443	23.9385	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-499.7352	0.1325	-66.2196	
PV Unit electricity exported	-257.7462	0.1225	-31.5622	
Total			-97.7818	(269)
Total CO2, kg/year			458.5117	(272)
CO2 emissions per m2			6.4600	(273)
EI value			94.7025	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		70.9800 (1b)	x	3.0000 (2b)	=	212.9400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	212.9400	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.7700	1.2357	13.3089			(27)
External Wall 1	25.3500	10.7700	14.5800	0.1400	2.0412	14.0000	204.1200	(29a)
External Roof 1	70.9800		70.9800	0.1100	7.8078	9.0000	638.8200	(30)
Total net area of external elements Aum(A, m2)			96.3300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	23.1579			(33)
Party Wall 1			58.4700	0.0000	0.0000	20.0000	1169.4000	(32)
Wall to corridor			17.2800	0.0000	0.0000	20.0000	345.6000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Internal Wall 1			153.9000			9.0000	1385.1000	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9421.4400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 132.7337 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	4.6400	0.0500	0.2320
E4 Jamb	27.8400	0.0500	1.3920
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18 Party wall between dwellings	6.0000	0.0600	0.3600
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000
E15 Flat roof with parapet	8.4500	0.5600	4.7320
P4 Party wall - Roof (insulation at ceiling level)	25.2500	0.1200	3.0300

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.3375 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 33.4954 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	20.4574	20.4574	20.0490	18.8236	18.6194	17.8025	17.3941	17.3941	18.2110	19.2321	19.6405	19.4363	(38)
Heat transfer coeff	53.9528	53.9528	53.5444	52.3191	52.1148	51.2980	50.8895	50.8895	51.7064	52.7275	53.1360	52.9317	(39)

Average = Sum(39)m / 12 = 52.4552

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7601	0.7601	0.7544	0.7371	0.7342	0.7227	0.7170	0.7170	0.7285	0.7429	0.7486	0.7457	(40)
HLP (average)												0.7390	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2697 (42)

Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day) 138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)

Energy content (annual) Total = Sum(45)m = 2297.5146
Distribution loss (46)m = 0.15 x (45)m

	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)

Total per year (kWh/year) = Sum(64)m = 2544.5466 (64)
Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month

	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	23.4790	20.8538	16.9595	12.8394	9.5976	8.1027	8.7553	11.3804	15.2748	19.3948	22.6366	24.1315	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)

Water heating gains (Table 5)

	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)

Total internal gains

	546.6468	544.4702	527.5591	495.2123	463.9464	435.3471	418.2106	421.4595	437.5134	466.4610	501.7873	532.6536	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.7700	10.0309	0.6300	0.8270	0.7700	39.0064	(75)

Solar gains	39.0064	84.4476	158.7276	275.0250	367.7778	382.1355	361.4694	278.9456	191.8002	102.4648	50.3815	32.6165	(83)
Total gains	585.6532	628.9178	686.2866	770.2373	831.7242	817.4825	779.6800	700.4051	629.3136	568.9258	552.1688	565.2701	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.5066	48.5066	48.8766	50.0213	50.2173	51.0170	51.4265	51.4265	50.6140	49.6338	49.2523	49.4423	
alpha	4.2338	4.2338	4.2584	4.3348	4.3478	4.4011	4.4284	4.4284	4.3743	4.3089	4.2835	4.2962	
util living area													
	0.9412	0.9222	0.8760	0.7623	0.6077	0.4785	0.3941	0.4431	0.6294	0.8299	0.9162	0.9478	(86)
MIT	19.9952	20.1315	20.3945	20.7322	20.9144	20.9754	20.9913	20.9859	20.9236	20.6635	20.2959	19.9671	(87)
Th 2	20.2880	20.2880	20.2931	20.3082	20.3107	20.3208	20.3259	20.3259	20.3158	20.3031	20.2981	20.3006	(88)
util rest of house													
	0.9332	0.9121	0.8607	0.7373	0.5739	0.4396	0.3518	0.3972	0.5865	0.8045	0.9037	0.9407	(89)
MIT 2	19.1158	19.2847	19.6112	20.0239	20.2283	20.3001	20.3195	20.3154	20.2473	19.9491	19.5005	19.0903	(90)
Living area fraction									fLA = Living area / (4) =			0.4060	(91)
MIT	19.4729	19.6285	19.9292	20.3115	20.5069	20.5743	20.5923	20.5876	20.5219	20.2392	19.8235	19.4463	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4729	19.6285	19.9292	20.3115	20.5069	20.5743	20.5923	20.5876	20.5219	20.2392	19.8235	19.4463	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9226	0.9013	0.8521	0.7375	0.5837	0.4542	0.3686	0.4152	0.5998	0.8020	0.8941	0.9304	(94)
Useful gains	540.2983	566.8534	584.7677	568.0190	485.4752	371.3348	287.3965	290.8138	377.4328	456.2637	493.6774	525.9357	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	840.2019	827.0179	767.2506	649.3587	511.0844	378.2840	289.6767	294.5298	399.2729	555.7049	702.6416	833.4774	(97)
Space heating kWh													
	223.1283	174.8306	135.7673	58.5646	19.0532	0.0000	0.0000	0.0000	0.0000	73.9842	150.4542	228.8110	(98a)
Space heating requirement - total per year (kWh/year)												1064.5934	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	223.1283	174.8306	135.7673	58.5646	19.0532	0.0000	0.0000	0.0000	0.0000	73.9842	150.4542	228.8110	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1064.5934	
Space heating per m2										(98c) / (4) =		14.9985	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	223.1283	174.8306	135.7673	58.5646	19.0532	0.0000	0.0000	0.0000	0.0000	73.9842	150.4542	228.8110	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	223.1283	174.8306	135.7673	58.5646	19.0532	0.0000	0.0000	0.0000	0.0000	73.9842	150.4542	228.8110	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													

	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	16.3716	14.7872	16.3716	15.8434	16.3716	15.8434	16.3716	16.3716	15.8434	16.3716	15.8434	16.3716	(231)
Lighting	20.5510	16.4868	14.8445	10.8757	8.4007	6.8635	7.6634	9.9612	12.9386	16.9762	19.1746	21.1222	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.6009	-26.5524	-44.9728	-58.4363	-67.1465	-62.6449	-62.1773	-54.8827	-44.5362	-32.0833	-18.4984	-13.4036	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.5730	-6.6773	-16.2649	-30.6118	-43.7418	-44.0139	-44.0864	-34.1989	-23.0757	-10.7094	-3.8261	-2.0310	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1064.5934	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2544.5466	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	192.7618	(230a)
Total electricity for the above, kWh/year	192.7618	(231)
Electricity for lighting (calculated in Appendix L)	165.8585	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-762.7453	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3205.0149	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1064.5934	25.1600	267.8517	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	25.1600	640.2079	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	192.7618	25.1600	48.4989	(249)
Energy for lighting	165.8585	25.1600	41.7300	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-500.9353	25.1600	-126.0353	
PV Unit electricity exported	-261.8100	5.8100	-15.2112	
Total			-141.2465	(252)
Total energy cost			857.0420	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1064.5934	0.1560	166.0816	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			525.6262	(265)
Pumps, fans and electric keep-hot	192.7618	0.1387	26.7384	(267)
Energy for lighting	165.8585	0.1443	23.9385	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-500.9353	0.1322	-66.2326	
PV Unit electricity exported	-261.8100	0.1219	-31.9105	
Total			-98.1431	(269)
Total CO2, kg/year			478.1600	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1064.5934	1.5776	1679.4684	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	1.5225	3874.0629	(278)
Space and water heating			5553.5313	(279)
Pumps, fans and electric keep-hot	192.7618	1.5128	291.6101	(281)
Energy for lighting	165.8585	1.5338	254.3994	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-500.9353	1.4885	-745.6590	
PV Unit electricity exported	-261.8100	0.4472	-117.0923	
Total			-862.7513	(283)
Total Primary energy kWh/year			5236.7894	(286)

SAP 10 EPC IMPROVEMENTS

Unit 218 L08_Copy

Current energy efficiency rating: C 73
Current environmental impact rating: A 95

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 73
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£998	£998	£0
Space heating	£316	£316	£0
Water heating	£640	£640	£0
Lighting	£42	£42	£0
Generated (PV)	-£141	-£141	£0
Total cost of fuels	£857	£857	£0
Total cost of uses	£857	£857	£0
Delivered energy	45 kWh/m²	45 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.5 tonnes	0.0 tonnes
CO2 emissions per m²	7 kg/m²	7 kg/m²	0 kg/m²
Primary energy	74 kWh/m²	74 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.9800	(1b)	x 3.0000	(2b) =	212.9400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		212.9400	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.7700	1.2357	13.3089			(27)
External Wall 1	25.3500	10.7700	14.5800	0.1400	2.0412	14.0000	204.1200	(29a)
External Roof 1	70.9800		70.9800	0.1100	7.8078	9.0000	638.8200	(30)
Total net area of external elements Aum(A, m2)			96.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		23.1579			(33)
Party Wall 1			58.4700	0.0000	0.0000	20.0000	1169.4000	(32)
Wall to corridor			17.2800	0.0000	0.0000	20.0000	345.6000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Internal Wall 1			153.9000			9.0000	1385.1000	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9421.4400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 132.7337 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	4.6400	0.0500	0.2320
E4 Jamb	27.8400	0.0500	1.3920
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18 Party wall between dwellings	6.0000	0.0600	0.3600
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000
E15 Flat roof with parapet	8.4500	0.5600	4.7320
P4 Party wall - Roof (insulation at ceiling level)	25.2500	0.1200	3.0300

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.3375 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 33.4954 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	20.2532	20.0490	19.8447	18.8236	18.6194	17.5983	17.5983	17.3941	18.0067	18.6194	19.0279	19.4363	(38)
Heat transfer coeff	53.7486	53.5444	53.3402	52.3191	52.1148	51.0937	51.0937	50.8895	51.5022	52.1148	52.5233	52.9317	(39)

Average = Sum(39)m / 12 = 52.2680

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7572	0.7544	0.7515	0.7371	0.7342	0.7198	0.7198	0.7170	0.7256	0.7342	0.7400	0.7457	(40)
HLP (average)												0.7364	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2697 (42)
Hot water usage for mixer showers

85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)

Hot water usage for baths

26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)

Hot water usage for other uses

37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day) 138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h												
259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
									Total per year (kWh/year) = Sum(64)m =		2544.5466	(64)
Electric shower(s)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.4790	20.8538	16.9595	12.8394	9.5976	8.1027	8.7553	11.3804	15.2748	19.3948	22.6366	24.1315	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(70)
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains													

	546.6468	544.4702	527.5591	495.2123	463.9464	435.3471	418.2106	421.4595	437.5134	466.4610	501.7873	532.6536 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.7700	11.2829	0.6300	0.8270	0.7700	43.8750	(75)

Solar gains	43.8750	89.3089	160.9062	264.2542	355.2095	378.6909	354.2576	282.4182	196.0667	109.1425	55.2061	35.8305	(83)
Total gains	590.5219	633.7791	688.4652	759.4665	819.1559	814.0379	772.4682	703.8778	633.5801	575.6035	556.9934	568.4842	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.6909	48.8766	49.0637	50.0213	50.2173	51.2209	51.2209	51.4265	50.8147	50.2173	49.8268	49.4423	
alpha	4.2461	4.2584	4.2709	4.3348	4.3478	4.4147	4.4147	4.4284	4.3876	4.3478	4.3218	4.2962	
util living area	0.9350	0.9109	0.8542	0.7321	0.5654	0.3974	0.2901	0.3309	0.5405	0.7878	0.9035	0.9418	(86)
MIT	20.0643	20.2280	20.4972	20.7900	20.9413	20.9904	20.9981	20.9967	20.9647	20.7584	20.3822	20.0380	(87)
Th 2	20.2905	20.2931	20.2956	20.3082	20.3107	20.3233	20.3233	20.3259	20.3183	20.3107	20.3057	20.3006	(88)
util rest of house	0.9261	0.8992	0.8362	0.7040	0.5290	0.3567	0.2459	0.2831	0.4926	0.7573	0.8892	0.9338	(89)
MIT 2	19.2042	19.4084	19.7380	20.0907	20.2566	20.3161	20.3223	20.3240	20.2897	20.0650	19.6125	19.1795	(90)
Living area fraction										fLA = Living area / (4) =		0.4060	(91)
MIT	19.5535	19.7412	20.0463	20.3747	20.5346	20.5899	20.5967	20.5971	20.5637	20.3465	19.9250	19.5281	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5535	19.7412	20.0463	20.3747	20.5346	20.5899	20.5967	20.5971	20.5637	20.3465	19.9250	19.5281	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9154	0.8889	0.8293	0.7068	0.5410	0.3728	0.2638	0.3024	0.5101	0.7589	0.8804	0.9234	(94)
Useful gains	540.5798	563.3894	570.9652	536.8287	443.1543	303.4901	203.7839	212.8317	323.2127	436.8519	490.3625	524.9557	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	819.8528	794.6643	722.5594	600.3431	460.4157	306.0460	204.2067	213.5897	332.8971	507.9370	673.6135	811.3419	(97)
Space heating kWh	207.7791	155.4168	112.7861	45.7304	12.8425	0.0000	0.0000	0.0000	0.0000	52.8874	131.9407	213.0713	(98a)
Space heating requirement - total per year (kWh/year)												932.4542	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	207.7791	155.4168	112.7861	45.7304	12.8425	0.0000	0.0000	0.0000	0.0000	52.8874	131.9407	213.0713	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												932.4542	
Space heating per m2											(98c) / (4) =	13.1369	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	207.7791	155.4168	112.7861	45.7304	12.8425	0.0000	0.0000	0.0000	0.0000	52.8874	131.9407	213.0713	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	207.7791	155.4168	112.7861	45.7304	12.8425	0.0000	0.0000	0.0000	0.0000	52.8874	131.9407	213.0713	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	16.3716	14.7872	16.3716	15.8434	16.3716	15.8434	16.3716	16.3716	15.8434	16.3716	15.8434	16.3716	(231)
Lighting	20.5510	16.4868	14.8445	10.8757	8.4007	6.8635	7.6634	9.9612	12.9386	16.9762	19.1746	21.1222	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-17.2251	-27.5333	-44.7261	-55.7351	-64.6285	-61.7507	-60.7753	-54.8660	-44.8311	-33.2957	-19.8659	-14.5024	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.0524	-7.2284	-16.5326	-28.6945	-41.2192	-42.8265	-42.2124	-34.1796	-23.3507	-11.7403	-4.3780	-2.3317	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity)

(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	932.4542	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2544.5466	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	192.7618	(230a)
Total electricity for the above, kWh/year	192.7618	(231)
Electricity for lighting (calculated in Appendix L)	165.8585	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-757.4814	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3078.1397	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	932.4542	16.4900	153.7617	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	16.4900	419.5957	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	192.7618	16.4900	31.7864	(249)
Energy for lighting	165.8585	16.4900	27.3501	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-499.7352	16.4900	-82.4063	
PV Unit electricity exported	-257.7462	5.5900	-14.4080	
Total			-96.8143	(252)
Total energy cost			535.6796	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.6627	(257)
SAP value	73.0470	
SAP rating (Section 12)	73	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	932.4542	0.1567	146.0720	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			505.6165	(265)
Pumps, fans and electric keep-hot	192.7618	0.1387	26.7384	(267)
Energy for lighting	165.8585	0.1443	23.9385	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-499.7352	0.1325	-66.2196	
PV Unit electricity exported	-257.7462	0.1225	-31.5622	
Total			-97.7818	(269)
Total CO2, kg/year			458.5117	(272)
CO2 emissions per m2			6.4600	(273)
EI value			94.7025	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		70.9800 (1b)	x	3.0000 (2b)	=	212.9400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		212.9400	(5)

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2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.7700	1.2357	13.3089			(27)
External Wall 1	25.3500	10.7700	14.5800	0.1400	2.0412	14.0000	204.1200	(29a)
External Roof 1	70.9800		70.9800	0.1100	7.8078	9.0000	638.8200	(30)
Total net area of external elements Aum(A, m2)			96.3300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	23.1579			(33)
Party Wall 1			58.4700	0.0000	0.0000	20.0000	1169.4000	(32)
Wall to corridor			17.2800	0.0000	0.0000	20.0000	345.6000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Internal Wall 1			153.9000			9.0000	1385.1000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9421.4400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		132.7337 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	4.6400	0.0500	0.2320
E4 Jamb	27.8400	0.0500	1.3920
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18 Party wall between dwellings	6.0000	0.0600	0.3600
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000
E15 Flat roof with parapet	8.4500	0.5600	4.7320
P4 Party wall - Roof (insulation at ceiling level)	25.2500	0.1200	3.0300

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.3375 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	33.4954 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	20.4574	20.4574	20.0490	18.8236	18.6194	17.8025	17.3941	17.3941	18.2110	19.2321	19.6405	19.4363	(38)
Heat transfer coeff	53.9528	53.9528	53.5444	52.3191	52.1148	51.2980	50.8895	50.8895	51.7064	52.7275	53.1360	52.9317	(39)
Average = Sum(39)m / 12 =												52.4552	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7601	0.7601	0.7544	0.7371	0.7342	0.7227	0.7170	0.7170	0.7285	0.7429	0.7486	0.7457	(40)
HLP (average)												0.7390	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.2697 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)

Hot water usage for baths

26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)

Hot water usage for other uses

37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day)	138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	

Distribution loss (46)m = 0.15 x (45)m

35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)

Total per year (kWh/year) = Sum(64)m = 2544.5466 (64)

Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	23.4790	20.8538	16.9595	12.8394	9.5976	8.1027	8.7553	11.3804	15.2748	19.3948	22.6366	24.1315	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)

Water heating gains (Table 5)

	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)

Total internal gains

	546.6468	544.4702	527.5591	495.2123	463.9464	435.3471	418.2106	421.4595	437.5134	466.4610	501.7873	532.6536	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.7700	10.0309	0.6300	0.8270	0.7700	39.0064	(75)

Solar gains	39.0064	84.4476	158.7276	275.0250	367.7778	382.1355	361.4694	278.9456	191.8002	102.4648	50.3815	32.6165	(83)
Total gains	585.6532	628.9178	686.2866	770.2373	831.7242	817.4825	779.6800	700.4051	629.3136	568.9258	552.1688	565.2701	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.5066	48.5066	48.8766	50.0213	50.2173	51.0170	51.4265	51.4265	50.6140	49.6338	49.2523	49.4423	
alpha	4.2338	4.2338	4.2584	4.3348	4.3478	4.4011	4.4284	4.4284	4.3743	4.3089	4.2835	4.2962	
util living area													
	0.9412	0.9222	0.8760	0.7623	0.6077	0.4785	0.3941	0.4431	0.6294	0.8299	0.9162	0.9478	(86)
MIT	19.9952	20.1315	20.3945	20.7322	20.9144	20.9754	20.9913	20.9859	20.9236	20.6635	20.2959	19.9671	(87)
Th 2	20.2880	20.2880	20.2931	20.3082	20.3107	20.3208	20.3259	20.3259	20.3158	20.3031	20.2981	20.3006	(88)
util rest of house													
	0.9332	0.9121	0.8607	0.7373	0.5739	0.4396	0.3518	0.3972	0.5865	0.8045	0.9037	0.9407	(89)
MIT 2	19.1158	19.2847	19.6112	20.0239	20.2283	20.3001	20.3195	20.3154	20.2473	19.9491	19.5005	19.0903	(90)

Living area fraction fLA = Living area / (4) = 0.4060 (91)

MIT	19.4729	19.6285	19.9292	20.3115	20.5069	20.5743	20.5923	20.5876	20.5219	20.2392	19.8235	19.4463	(92)

Temperature adjustment 0.0000

adjusted MIT	19.4729	19.6285	19.9292	20.3115	20.5069	20.5743	20.5923	20.5876	20.5219	20.2392	19.8235	19.4463	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9226	0.9013	0.8521	0.7375	0.5837	0.4542	0.3686	0.4152	0.5998	0.8020	0.8941	0.9304	(94)
Useful gains	540.2983	566.8534	584.7677	568.0190	485.4752	371.3348	287.3965	290.8138	377.4328	456.2637	493.6774	525.9357	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	840.2019	827.0179	767.2506	649.3587	511.0844	378.2840	289.6767	294.5298	399.2729	555.7049	702.6416	833.4774	(97)
Space heating kWh													
	223.1283	174.8306	135.7673	58.5646	19.0532	0.0000	0.0000	0.0000	0.0000	73.9842	150.4542	228.8110	(98a)

Space heating requirement - total per year (kWh/year) 1064.5934

Solar heating kWh

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)

Solar heating contribution - total per year (kWh/year) 0.0000

Space heating kWh

	223.1283	174.8306	135.7673	58.5646	19.0532	0.0000	0.0000	0.0000	0.0000	73.9842	150.4542	228.8110	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 1064.5934

Space heating per m2 (98c) / (4) = 14.9985 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	223.1283	174.8306	135.7673	58.5646	19.0532	0.0000	0.0000	0.0000	0.0000	73.9842	150.4542	228.8110	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	223.1283	174.8306	135.7673	58.5646	19.0532	0.0000	0.0000	0.0000	0.0000	73.9842	150.4542	228.8110	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	16.3716	14.7872	16.3716	15.8434	16.3716	15.8434	16.3716	16.3716	15.8434	16.3716	15.8434	16.3716	(231)
Lighting	20.5510	16.4868	14.8445	10.8757	8.4007	6.8635	7.6634	9.9612	12.9386	16.9762	19.1746	21.1222	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.6009	-26.5524	-44.9728	-58.4363	-67.1465	-62.6449	-62.1773	-54.8827	-44.5362	-32.0833	-18.4984	-13.4036	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.5730	-6.6773	-16.2649	-30.6118	-43.7418	-44.0139	-44.0864	-34.1989	-23.0757	-10.7094	-3.8261	-2.0310	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1	1064.5934	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2544.5466	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	192.7618	(230a)
Total electricity for the above, kWh/year	192.7618	(231)
Electricity for lighting (calculated in Appendix L)	165.8585	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-762.7453	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3205.0149	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1064.5934	25.1600	267.8517	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	25.1600	640.2079	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	192.7618	25.1600	48.4989	(249)
Energy for lighting	165.8585	25.1600	41.7300	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-500.9353	25.1600	-126.0353	
PV Unit electricity exported	-261.8100	5.8100	-15.2112	
Total			-141.2465	(252)
Total energy cost			857.0420	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1064.5934	0.1560	166.0816	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			525.6262	(265)
Pumps, fans and electric keep-hot	192.7618	0.1387	26.7384	(267)
Energy for lighting	165.8585	0.1443	23.9385	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-500.9353	0.1322	-66.2326	
PV Unit electricity exported	-261.8100	0.1219	-31.9105	
Total			-98.1431	(269)
Total CO2, kg/year			478.1600	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1064.5934	1.5776	1679.4684	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	1.5225	3874.0629	(278)
Space and water heating			5553.5313	(279)
Pumps, fans and electric keep-hot	192.7618	1.5128	291.6101	(281)
Energy for lighting	165.8585	1.5338	254.3994	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-500.9353	1.4885	-745.6590	
PV Unit electricity exported	-261.8100	0.4472	-117.0923	
Total			-862.7513	(283)
Total Primary energy kWh/year			5236.7894	(286)

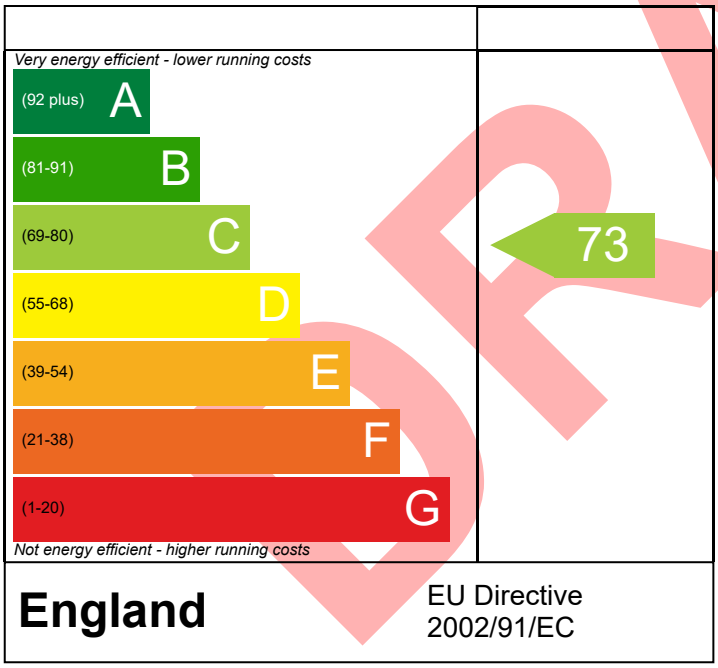
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	70.98 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

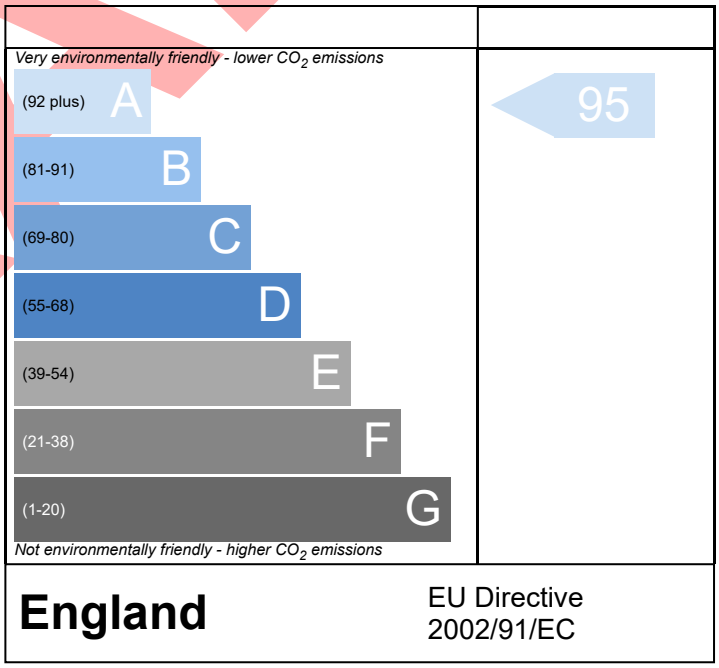
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:43

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	66 m^2
Site Reference	Unit 219 L08_Copy	Plot Reference	Unit 219 L08_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*15.71 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	7.96 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*84.77 kWh_{PE}/m^2*	
Dwelling primary energy	86.05 kWh_{PE}/m^2	FAIL
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*42.3 kWh/m^2*	
Dwelling fabric energy efficiency	40.6 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	*1.6*	1.3	SE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	31.84	0.14 **(!)**
Party wall: Party Wall (1)	61.13	0 **(!)**
Party wall: Party Wall (2)	4.27	0 **(!)**
Exposed roof: Roof (1)	66.41	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SE, Opening Type 1	10.77	South East	0.83	1.3
NE, Opening Type 1	7.18	North East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E15: Flat roof with parapet	Calculated by person with suitable expertise	0.56	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.12	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.86 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 219 L08_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 219 L08_Copy	**Prop Type Ref**	Unit 219 L08
Property			

SAP Rating	69 C	**DER**	7.96	**TER**	15.71
Environmental	94 A	**% DER < TER**			49.33
CO_2 Emissions (t/year)	0.54	**DFEE**	40.62	**TFEE**	42.31
Compliance Check	See BREL	**% DFEE < TFEE**			4.00
% DPER < TPER	-1.51	**DPER**	86.05	**TPER**	84.77

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.4100	(1b)	x 3.0000	(2b) =	199.2300	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.4100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		199.2300	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			17.9500	1.2357	22.1816			(27)
External Wall 1	49.7900	17.9500	31.8400	0.1400	4.4576	14.0000	445.7600	(29a)
External Roof 1	66.4100		66.4100	0.1100	7.3051	9.0000	597.6900	(30)
Total net area of external elements Aum(A, m2)			116.2000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.9443			(33)
Party Wall 1			61.1300	0.0000	0.0000	20.0000	1222.6000	(32)
Wall to corridor			4.2700	0.0000	0.0000	20.0000	85.4000	(32)
Party Floor 1			66.4100			80.0000	5312.8000	(32d)
Internal Wall 1			155.8800			9.0000	1402.9200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9067.1700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		136.5332 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	7.7300	0.0500	0.3865

E4 Jamb	46.4000	0.0500	2.3200	
E7 Party floor between dwellings (in blocks of flats)	16.5900	0.0700	1.1613	
E18 Party wall between dwellings	6.0000	0.0600	0.3600	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	21.8000	0.0000	0.0000	
E16 Corner (normal)	6.0000	0.0900	0.5400	
E17 Corner (inverted - internal area greater than external area)	3.0000	0.0000	0.0000	
E15 Flat roof with parapet	16.5900	0.5600	9.2904	
P4 Party wall - Roof (insulation at ceiling level)	21.8000	0.1200	2.6160	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.6742 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 50.6185 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	19.8922	19.6827	19.4731	18.4253	18.2157	17.1679	17.1679	16.9583	17.5870	18.2157	18.6349	19.0540	(38)
Heat transfer coeff	70.5107	70.3011	70.0916	69.0437	68.8342	67.7864	67.7864	67.5768	68.2055	68.8342	69.2533	69.6724	(39)

Average = Sum(39)m / 12 = 68.9914

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0617	1.0586	1.0554	1.0397	1.0365	1.0207	1.0207	1.0176	1.0270	1.0365	1.0428	1.0491	(40)
HLP (average)												1.0389	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1559 (42)

Hot water usage for mixer showers

83.0050	81.7576	79.9399	76.4620	73.8955	71.0332	69.4063	71.2103	73.1878	76.2609	79.8135	82.6870	(42a)

Hot water usage for baths

26.0831	25.6958	25.1503	24.1445	23.3913	22.5562	22.1051	22.6468	23.2366	24.1302	25.1567	25.9950	(42b)

Hot water usage for other uses

36.7088	35.3739	34.0390	32.7042	31.3693	30.0344	30.0344	31.3693	32.7042	34.0390	35.3739	36.7088	(42c)

Average daily hot water use (litres/day) 134.0826 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7969	142.8273	139.1292	133.3107	128.6561	123.6239	121.5459	125.2264	129.1285	134.4302	140.3441	145.3907	(44)
Energy conte	230.9067	203.3841	213.8364	182.4956	173.1958	152.0100	146.9993	155.0565	159.2284	182.4205	199.9459	227.6467	(45)
Energy content (annual)										Total = Sum(45)m =		2227.1258	
Distribution loss (46)m = 0.15 x (45)m	34.6360	30.5076	32.0755	27.3743	25.9794	22.8015	22.0499	23.2585	23.8843	27.3631	29.9919	34.1470	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)

Total per year (kWh/year) = Sum(64)m = 2474.1578 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

93.5611	82.7855	87.8852	76.9230	74.3722	66.7865	65.6619	68.3409	69.1866	77.4394	82.7252	92.4772	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7302	19.3006	15.6963	11.8831	8.8827	7.4992	8.1031	10.5328	14.1371	17.9502	20.9506	22.3341	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.7577	284.6815	277.3137	261.6285	241.8288	223.2199	210.7880	207.8643	215.2321	230.9172	250.7169	269.3258	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	(71)
Water heating gains (Table 5)	125.7542	123.1928	118.1253	106.8375	99.9627	92.7591	88.2552	91.8561	96.0926	104.0853	114.8961	124.2973	(72)
Total internal gains	522.4518	520.3846	504.3451	473.5589	443.8841	416.6880	400.3562	403.4629	418.6715	446.1625	479.7734	509.1670	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.1800	11.2829	0.6300	0.8270	0.7700	29.2500	(75)
Southeast	10.7700	36.7938	0.6300	0.8270	0.7700	143.0771	(77)

Solar gains	172.3271	303.2524	440.7298	589.3413	699.5932	711.9009	679.1212	594.2132	491.7767	342.1167	208.1774	146.3312	(83)
Total gains	694.7789	823.6370	945.0748	1062.9002	1143.4773	1128.5888	1079.4774	997.6761	910.4482	788.2792	687.9508	655.4982	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	35.7202	35.8267	35.9338	36.4792	36.5902	37.1558	37.1558	37.2711	36.9275	36.5902	36.3688	36.1500	
alpha	3.3813	3.3884	3.3956	3.4319	3.4393	3.4771	3.4771	3.4847	3.4618	3.4393	3.4246	3.4100	
util living area	0.9236	0.8767	0.7997	0.6738	0.5236	0.3758	0.2740	0.3079	0.4901	0.7361	0.8833	0.9340	(86)
MIT	19.6163	19.9409	20.3260	20.6901	20.8921	20.9745	20.9935	20.9903	20.9363	20.6471	20.0784	19.5531	(87)
Th 2	20.0322	20.0348	20.0374	20.0504	20.0530	20.0661	20.0661	20.0687	20.0609	20.0530	20.0478	20.0426	(88)
util rest of house	0.9118	0.8594	0.7740	0.6375	0.4782	0.3237	0.2168	0.2470	0.4310	0.6955	0.8639	0.9236	(89)
MIT 2	18.4558	18.8537	19.3160	19.7428	19.9589	20.0486	20.0630	20.0638	20.0133	19.7111	19.0405	18.3853	(90)
Living area fraction										fLA = Living area / (4) =		0.3439	(91)
MIT	18.8549	19.2276	19.6633	20.0686	20.2798	20.3671	20.3831	20.3825	20.3308	20.0330	19.3974	18.7869	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8549	19.2276	19.6633	20.0686	20.2798	20.3671	20.3831	20.3825	20.3308	20.0330	19.3974	18.7869	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8945	0.8428	0.7631	0.6382	0.4893	0.3407	0.2363	0.2677	0.4484	0.6946	0.8486	0.9070	(94)
Useful gains	621.5092	694.2006	721.2168	678.3886	559.5019	384.4679	255.1166	267.0728	408.2023	547.5390	583.7763	594.5166	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1026.2797	1007.2499	922.6397	771.1200	590.5869	390.9279	256.4392	269.1225	424.9716	649.3156	851.6389	1016.3054	(97)
Space heating kWh	301.1493	210.3691	149.8587	66.7667	23.1273	0.0000	0.0000	0.0000	0.0000	75.7218	192.8611	313.8108	(98a)
Space heating requirement - total per year (kWh/year)												1333.6647	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	301.1493	210.3691	149.8587	66.7667	23.1273	0.0000	0.0000	0.0000	0.0000	75.7218	192.8611	313.8108	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1333.6647	
Space heating per m2											(98c) / (4) =	20.0823	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 100.0000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	301.1493	210.3691	149.8587	66.7667	23.1273	0.0000	0.0000	0.0000	0.0000	75.7218	192.8611	313.8108	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	301.1493	210.3691	149.8587	66.7667	23.1273	0.0000	0.0000	0.0000	0.0000	75.7218	192.8611	313.8108	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	14.4505	13.0520	14.4505	13.9843	14.4505	13.9843	14.4505	14.4505	13.9843	14.4505	13.9843	14.4505	(231)
Lighting	19.0203	15.2588	13.7389	10.0657	7.7750	6.3523	7.0926	9.2193	11.9749	15.7117	17.7464	19.5489	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.3067	-26.0980	-42.4153	-52.8724	-61.1492	-58.0868	-57.1680	-51.5850	-42.1163	-31.4801	-18.8149	-13.7245	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.6483	-6.3967	-14.8482	-26.0509	-37.7954	-39.6702	-39.1031	-31.6533	-21.6188	-10.6188	-3.8478	-2.0117	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 1333.6647 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 100.0000

Water heating fuel used 2474.1578 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)

mechanical ventilation fans (SFP = 0.7000) 170.1424 (230a)

Total electricity for the above, kWh/year 170.1424 (231)

Electricity for lighting (calculated in Appendix L) 153.5048 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	-708.0805	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3423.3892	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1333.6647	16.4900	219.9213	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	16.4900	407.9886	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	170.1424	16.4900	28.0565	(249)
Energy for lighting	153.5048	16.4900	25.3129	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-471.8172	16.4900	-77.8027	
PV Unit electricity exported	-236.2632	5.5900	-13.2071	
Total			-91.0098	(252)
Total energy cost			590.2696	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.9073	(257)
SAP value		69.0820	
SAP rating (Section 12)		69	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1333.6647	0.1566	208.8465	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2474.1578	0.1413	349.5790	(264)
Space and water heating			558.4256	(265)
Pumps, fans and electric keep-hot	170.1424	0.1387	23.6009	(267)
Energy for lighting	153.5048	0.1443	22.1555	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-471.8172	0.1326	-62.5469	
PV Unit electricity exported	-236.2632	0.1220	-28.8306	
Total			-91.3775	(269)
Total CO2, kg/year			512.8045	(272)
CO2 emissions per m2			7.7200	(273)
EI value			93.8322	
EI rating			94	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		66.4100 (1b)	x	3.0000 (2b)	=	199.2300	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.4100						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	199.2300	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)

Infiltration rate												0.1500	(18)
Number of sides sheltered												2	(19)
Shelter factor								(20) = 1 - [0.075 x (19)] =				0.8500	(20)
Infiltration rate adjusted to include shelter factor								(21) = (18) x (20) =				0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			17.9500	1.2357	22.1816			(27)
External Wall 1	49.7900	17.9500	31.8400	0.1400	4.4576	14.0000	445.7600	(29a)
External Roof 1	66.4100		66.4100	0.1100	7.3051	9.0000	597.6900	(30)
Total net area of external elements Aum(A, m2)			116.2000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.9443			(33)
Party Wall 1			61.1300	0.0000	0.0000	20.0000	1222.6000	(32)
Wall to corridor			4.2700	0.0000	0.0000	20.0000	85.4000	(32)
Party Floor 1			66.4100			80.0000	5312.8000	(32d)
Internal Wall 1			155.8800			9.0000	1402.9200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 9067.1700	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	136.5332	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	7.7300	0.0500	0.3865
E4 Jamb	46.4000	0.0500	2.3200
E7 Party floor between dwellings (in blocks of flats)	16.5900	0.0700	1.1613
E18 Party wall between dwellings	6.0000	0.0600	0.3600
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	21.8000	0.0000	0.0000
E16 Corner (normal)	6.0000	0.0900	0.5400
E17 Corner (inverted - internal area greater than external area)	3.0000	0.0000	0.0000
E15 Flat roof with parapet	16.5900	0.5600	9.2904
P4 Party wall - Roof (insulation at ceiling level)	21.8000	0.1200	2.6160

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	16.6742	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	50.6185	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	20.1018	20.1018	19.6827	18.4253	18.2157	17.3775	16.9583	16.9583	17.7966	18.8444	19.2635	19.0540	(38)
Heat transfer coeff	70.7203	70.7203	70.3011	69.0437	68.8342	67.9959	67.5768	67.5768	68.4151	69.4629	69.8820	69.6724	(39)
Average = Sum(39)m / 12 =												69.1835	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0649	1.0649	1.0586	1.0397	1.0365	1.0239	1.0176	1.0176	1.0302	1.0460	1.0523	1.0491	(40)
HLP (average)												1.0418	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1559	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	83.0050	81.7576	79.9399	76.4620	73.8955	71.0332	69.4063	71.2103	73.1878	76.2609	79.8135	82.6870	(42a)
Hot water usage for baths	26.0831	25.6958	25.1503	24.1445	23.3913	22.5562	22.1051	22.6468	23.2366	24.1302	25.1567	25.9950	(42b)
Hot water usage for other uses	36.7088	35.3739	34.0390	32.7042	31.3693	30.0344	30.0344	31.3693	32.7042	34.0390	35.3739	36.7088	(42c)
Average daily hot water use (litres/day)												134.0826	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7969	142.8273	139.1292	133.3107	128.6561	123.6239	121.5459	125.2264	129.1285	134.4302	140.3441	145.3907	(44)
Energy conte	230.9067	203.3841	213.8364	182.4956	173.1958	152.0100	146.9993	155.0565	159.2284	182.4205	199.9459	227.6467	(45)
Energy content (annual)										Total = Sum(45)m =		2227.1258	
Distribution loss (46)m = 0.15 x (45)m	34.6360	30.5076	32.0755	27.3743	25.9794	22.8015	22.0499	23.2585	23.8843	27.3631	29.9919	34.1470	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
										Total per year (kWh/year) = Sum(64)m =		2474.1578	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

	93.5611	82.7855	87.8852	76.9230	74.3722	66.7865	65.6619	68.3409	69.1866	77.4394	82.7252	92.4772	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	21.7302	19.3006	15.6963	11.8831	8.8827	7.4992	8.1031	10.5328	14.1371	17.9502	20.9506	22.3341	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	281.7577	284.6815	277.3137	261.6285	241.8288	223.2199	210.7880	207.8643	215.2321	230.9172	250.7169	269.3258	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	(71)

Water heating gains (Table 5)

	125.7542	123.1928	118.1253	106.8375	99.9627	92.7591	88.2552	91.8561	96.0926	104.0853	114.8961	124.2973	(72)

Total internal gains

	522.4518	520.3846	504.3451	473.5589	443.8841	416.6880	400.3562	403.4629	418.6715	446.1625	479.7734	509.1670	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.1800	10.0309	0.6300	0.8270	0.7700	26.0043	(75)
Southeast	10.7700	33.4622	0.6300	0.8270	0.7700	130.1217	(77)

Solar gains	156.1260	292.8617	444.0892	624.2330	734.0110	726.4143	701.3537	596.2354	490.8624	328.1960	193.7601	135.6247	(83)
Total gains	678.5779	813.2463	948.4342	1097.7919	1177.8951	1143.1023	1101.7099	999.6983	909.5339	774.3585	673.5335	644.7917	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	35.6144	35.6144	35.8267	36.4792	36.5902	37.0413	37.2711	37.2711	36.8144	36.2591	36.0416	36.1500	
alpha	3.3743	3.3743	3.3884	3.4319	3.4393	3.4694	3.4847	3.4847	3.4543	3.4173	3.4028	3.4100	
util living area	0.9321	0.8901	0.8203	0.6944	0.5552	0.4461	0.3665	0.4071	0.5664	0.7788	0.8983	0.9412	(86)
MIT	19.5120	19.8206	20.2127	20.6305	20.8569	20.9466	20.9778	20.9686	20.8806	20.5283	19.9610	19.4490	(87)
Th 2	20.0296	20.0296	20.0348	20.0504	20.0530	20.0635	20.0687	20.0687	20.0582	20.0452	20.0400	20.0426	(88)
util rest of house	0.9217	0.8747	0.7975	0.6614	0.5133	0.3973	0.3131	0.3498	0.5131	0.7439	0.8813	0.9321	(89)
MIT 2	18.3240	18.7020	19.1778	19.6740	19.9220	20.0214	20.0540	20.0474	19.9583	19.5706	18.8916	18.2547	(90)
Living area fraction										fLA = Living area / (4) =		0.3439	(91)
MIT	18.7326	19.0867	19.5337	20.0030	20.2436	20.3396	20.3717	20.3643	20.2755	19.9000	19.2594	18.6654	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7326	19.0867	19.5337	20.0030	20.2436	20.3396	20.3717	20.3643	20.2755	19.9000	19.2594	18.6654	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9046	0.8573	0.7844	0.6596	0.5219	0.4119	0.3306	0.3683	0.5258	0.7381	0.8650	0.9158	(94)
Useful gains	613.8382	697.2191	743.9803	724.1350	614.7704	470.8319	364.2490	368.1457	478.2405	571.5522	582.5992	590.4894	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	1048.9631	1045.7213	979.5561	835.6335	656.9225	485.4614	369.7611	376.0144	511.4358	708.5215	884.6639	1042.6767	(97)
Space heating kWh	323.7330	234.1935	175.2684	80.2789	31.3612	0.0000	0.0000	0.0000	0.0000	101.9051	217.4866	336.4274	(98a)
Space heating requirement - total per year (kWh/year)												1500.6540	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	323.7330	234.1935	175.2684	80.2789	31.3612	0.0000	0.0000	0.0000	0.0000	101.9051	217.4866	336.4274	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1500.6540	
Space heating per m2											(98c) / (4) =	22.5968	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	323.7330	234.1935	175.2684	80.2789	31.3612	0.0000	0.0000	0.0000	0.0000	101.9051	217.4866	336.4274	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	323.7330	234.1935	175.2684	80.2789	31.3612	0.0000	0.0000	0.0000	0.0000	101.9051	217.4866	336.4274	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating
Water heating requirement

	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	14.4505	13.0520	14.4505	13.9843	14.4505	13.9843	14.4505	14.4505	13.9843	14.4505	13.9843	14.4505 (231)
Lighting	19.0203	15.2588	13.7389	10.0657	7.7750	6.3523	7.0926	9.2193	11.9749	15.7117	17.7464	19.5489 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-14.7645	-25.1682	-42.6559	-55.4609	-63.6212	-58.9317	-58.4927	-51.6007	-41.8384	-30.3583	-17.5184	-12.6815 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.2242	-5.8944	-14.5880	-27.7797	-40.0352	-40.7711	-40.8407	-31.6711	-21.3640	-9.6436	-3.3502	-1.7465 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year

Space heating fuel - main system 1	1500.6540 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2474.1578 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	170.1424 (230a)
Total electricity for the above, kWh/year	170.1424 (231)
Electricity for lighting (calculated in Appendix L)	153.5048 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-713.0011 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3585.4580 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1500.6540	25.1600	377.5645	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	25.1600	622.4981	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	170.1424	25.1600	42.8078	(249)
Energy for lighting	153.5048	25.1600	38.6218	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-473.0924	25.1600	-119.0300	
PV Unit electricity exported	-239.9087	5.8100	-13.9387	
Total			-132.9687	(252)
Total energy cost			948.5236	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1500.6540	0.1561	234.2123	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2474.1578	0.1413	349.5790	(264)
Space and water heating			583.7913	(265)
Pumps, fans and electric keep-hot	170.1424	0.1387	23.6009	(267)
Energy for lighting	153.5048	0.1443	22.1555	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-473.0924	0.1323	-62.5779	
PV Unit electricity exported	-239.9087	0.1215	-29.1392	
Total			-91.7171	(269)
Total CO2, kg/year			537.8305	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1500.6540	1.5778	2367.7110	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	1.5225	3766.8228	(278)
Space and water heating			6134.5338	(279)
Pumps, fans and electric keep-hot	170.1424	1.5128	257.3915	(281)
Energy for lighting	153.5048	1.5338	235.4508	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-473.0924	1.4887	-704.3146	
PV Unit electricity exported	-239.9087	0.4457	-106.9155	
Total			-811.2300	(283)
Total Primary energy kWh/year			5816.1460	(286)

SAP 10 EPC IMPROVEMENTS

Unit 219 L08_Copy

Current energy efficiency rating: C 69
Current environmental impact rating: A 94

N	Solar water heating		Not applicable
U	Solar photovoltaic panels		Not applicable
V2	Wind turbine		Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 69
Potential environmental impact rating: A 94

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£1081	£1081	£0
Space heating	£420	£420	£0
Water heating	£622	£622	£0
Lighting	£39	£39	£0
Generated (PV)	-£133	-£133	£0
Total cost of fuels	£948	£948	£0
Total cost of uses	£948	£948	£0
Delivered energy	54 kWh/m²	54 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.5 tonnes	0.0 tonnes
CO2 emissions per m²	8 kg/m²	8 kg/m²	0 kg/m²
Primary energy	88 kWh/m²	88 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.4100	(1b)	x 3.0000	(2b) =	199.2300	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.4100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		199.2300	(5)

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2. Ventilation rate
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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			17.9500	1.2357	22.1816			(27)
External Wall 1	49.7900	17.9500	31.8400	0.1400	4.4576	14.0000	445.7600	(29a)
External Roof 1	66.4100		66.4100	0.1100	7.3051	9.0000	597.6900	(30)
Total net area of external elements Aum(A, m2)			116.2000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.9443			(33)
Party Wall 1			61.1300	0.0000	0.0000	20.0000	1222.6000	(32)
Wall to corridor			4.2700	0.0000	0.0000	20.0000	85.4000	(32)
Party Floor 1			66.4100			80.0000	5312.8000	(32d)
Internal Wall 1			155.8800			9.0000	1402.9200	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9067.1700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 136.5332 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	7.7300	0.0500	0.3865
E4 Jamb	46.4000	0.0500	2.3200
E7 Party floor between dwellings (in blocks of flats)	16.5900	0.0700	1.1613
E18 Party wall between dwellings	6.0000	0.0600	0.3600
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	21.8000	0.0000	0.0000
E16 Corner (normal)	6.0000	0.0900	0.5400
E17 Corner (inverted - internal area greater than external area)	3.0000	0.0000	0.0000
E15 Flat roof with parapet	16.5900	0.5600	9.2904
P4 Party wall - Roof (insulation at ceiling level)	21.8000	0.1200	2.6160

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.6742 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 50.6185 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	19.8922	19.6827	19.4731	18.4253	18.2157	17.1679	17.1679	16.9583	17.5870	18.2157	18.6349	19.0540	(38)
Heat transfer coeff	70.5107	70.3011	70.0916	69.0437	68.8342	67.7864	67.7864	67.5768	68.2055	68.8342	69.2533	69.6724	(39)
Average = Sum(39)m / 12 =												68.9914	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0617	1.0586	1.0554	1.0397	1.0365	1.0207	1.0207	1.0176	1.0270	1.0365	1.0428	1.0491	(40)
HLP (average)												1.0389	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1559 (42)
Hot water usage for mixer showers

83.0050	81.7576	79.9399	76.4620	73.8955	71.0332	69.4063	71.2103	73.1878	76.2609	79.8135	82.6870	(42a)

Hot water usage for baths

26.0831	25.6958	25.1503	24.1445	23.3913	22.5562	22.1051	22.6468	23.2366	24.1302	25.1567	25.9950	(42b)

Hot water usage for other uses

36.7088	35.3739	34.0390	32.7042	31.3693	30.0344	30.0344	31.3693	32.7042	34.0390	35.3739	36.7088	(42c)

Average daily hot water use (litres/day) 134.0826 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7969	142.8273	139.1292	133.3107	128.6561	123.6239	121.5459	125.2264	129.1285	134.4302	140.3441	145.3907	(44)
Energy conte	230.9067	203.3841	213.8364	182.4956	173.1958	152.0100	146.9993	155.0565	159.2284	182.4205	199.9459	227.6467	(45)
Energy content (annual)										Total = Sum(45)m =		2227.1258	
Distribution loss (46)m = 0.15 x (45)m	34.6360	30.5076	32.0755	27.3743	25.9794	22.8015	22.0499	23.2585	23.8843	27.3631	29.9919	34.1470	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
										Total per year (kWh/year) = Sum(64)m =		2474.1578	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	93.5611	82.7855	87.8852	76.9230	74.3722	66.7865	65.6619	68.3409	69.1866	77.4394	82.7252	92.4772	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7302	19.3006	15.6963	11.8831	8.8827	7.4992	8.1031	10.5328	14.1371	17.9502	20.9506	22.3341	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.7577	284.6815	277.3137	261.6285	241.8288	223.2199	210.7880	207.8643	215.2321	230.9172	250.7169	269.3258	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367 (71)
Water heating gains (Table 5)												
	125.7542	123.1928	118.1253	106.8375	99.9627	92.7591	88.2552	91.8561	96.0926	104.0853	114.8961	124.2973 (72)
Total internal gains												
	522.4518	520.3846	504.3451	473.5589	443.8841	416.6880	400.3562	403.4629	418.6715	446.1625	479.7734	509.1670 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.1800	11.2829	0.6300	0.8270	0.7700	29.2500	(75)
Southeast	10.7700	36.7938	0.6300	0.8270	0.7700	143.0771	(77)

Solar gains	172.3271	303.2524	440.7298	589.3413	699.5932	711.9009	679.1212	594.2132	491.7767	342.1167	208.1774	146.3312 (83)
Total gains	694.7789	823.6370	945.0748	1062.9002	1143.4773	1128.5888	1079.4774	997.6761	910.4482	788.2792	687.9508	655.4982 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	35.7202	35.8267	35.9338	36.4792	36.5902	37.1558	37.1558	37.2711	36.9275	36.5902	36.3688	36.1500	
alpha	3.3813	3.3884	3.3956	3.4319	3.4393	3.4771	3.4771	3.4847	3.4618	3.4393	3.4246	3.4100	
util living area													
	0.9236	0.8767	0.7997	0.6738	0.5236	0.3758	0.2740	0.3079	0.4901	0.7361	0.8833	0.9340	(86)
MIT	19.6163	19.9409	20.3260	20.6901	20.8921	20.9745	20.9935	20.9903	20.9363	20.6471	20.0784	19.5531	(87)
Th 2	20.0322	20.0348	20.0374	20.0504	20.0530	20.0661	20.0661	20.0687	20.0609	20.0530	20.0478	20.0426	(88)
util rest of house													
	0.9118	0.8594	0.7740	0.6375	0.4782	0.3237	0.2168	0.2470	0.4310	0.6955	0.8639	0.9236	(89)
MIT 2	18.4558	18.8537	19.3160	19.7428	19.9589	20.0486	20.0630	20.0638	20.0133	19.7111	19.0405	18.3853	(90)
Living area fraction										fLA = Living area / (4) =		0.3439	(91)
MIT	18.8549	19.2276	19.6633	20.0686	20.2798	20.3671	20.3831	20.3825	20.3308	20.0330	19.3974	18.7869	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8549	19.2276	19.6633	20.0686	20.2798	20.3671	20.3831	20.3825	20.3308	20.0330	19.3974	18.7869	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8945	0.8428	0.7631	0.6382	0.4893	0.3407	0.2363	0.2677	0.4484	0.6946	0.8486	0.9070	(94)
Useful gains	621.5092	694.2006	721.2168	678.3886	559.5019	384.4679	255.1166	267.0728	408.2023	547.5390	583.7763	594.5166	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1026.2797	1007.2499	922.6397	771.1200	590.5869	390.9279	256.4392	269.1225	424.9716	649.3156	851.6389	1016.3054	(97)
Space heating kWh													
	301.1493	210.3691	149.8587	66.7667	23.1273	0.0000	0.0000	0.0000	0.0000	75.7218	192.8611	313.8108	(98a)
Space heating requirement - total per year (kWh/year)												1333.6647	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	301.1493	210.3691	149.8587	66.7667	23.1273	0.0000	0.0000	0.0000	0.0000	75.7218	192.8611	313.8108	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1333.6647	
Space heating per m2											(98c) / (4) =	20.0823	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	301.1493	210.3691	149.8587	66.7667	23.1273	0.0000	0.0000	0.0000	0.0000	75.7218	192.8611	313.8108	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	301.1493	210.3691	149.8587	66.7667	23.1273	0.0000	0.0000	0.0000	0.0000	75.7218	192.8611	313.8108	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	14.4505	13.0520	14.4505	13.9843	14.4505	13.9843	14.4505	14.4505	13.9843	14.4505	13.9843	14.4505	(231)
Lighting	19.0203	15.2588	13.7389	10.0657	7.7750	6.3523	7.0926	9.2193	11.9749	15.7117	17.7464	19.5489	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.3067	-26.0980	-42.4153	-52.8724	-61.1492	-58.0868	-57.1680	-51.5850	-42.1163	-31.4801	-18.8149	-13.7245	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													

(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.6483	-6.3967	-14.8482	-26.0509	-37.7954	-39.6702	-39.1031	-31.6533	-21.6188	-10.6188	-3.8478	-2.0117	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1333.6647	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2474.1578	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	170.1424	(230a)
Total electricity for the above, kWh/year	170.1424	(231)
Electricity for lighting (calculated in Appendix L)	153.5048	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-708.0805	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3423.3892	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1333.6647	16.4900	219.9213	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	16.4900	407.9886	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	170.1424	16.4900	28.0565	(249)
Energy for lighting	153.5048	16.4900	25.3129	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-471.8172	16.4900	-77.8027	
PV Unit electricity exported	-236.2632	5.5900	-13.2071	
Total			-91.0098	(252)
Total energy cost			590.2696	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.9073	(257)
SAP value	69.0820	
SAP rating (Section 12)	69	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1333.6647	0.1566	208.8465	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2474.1578	0.1413	349.5790	(264)
Space and water heating			558.4256	(265)
Pumps, fans and electric keep-hot	170.1424	0.1387	23.6009	(267)
Energy for lighting	153.5048	0.1443	22.1555	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-471.8172	0.1326	-62.5469	
PV Unit electricity exported	-236.2632	0.1220	-28.8306	
Total			-91.3775	(269)
Total CO2, kg/year			512.8045	(272)
CO2 emissions per m2			7.7200	(273)
EI value			93.8322	
EI rating			94	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area	Storey height	Volume	

	(m2)		(m)		(m3)	
Ground floor	66.4100 (1b)	x	3.0000 (2b)	=	199.2300	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.4100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	199.2300	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			17.9500	1.2357	22.1816			(27)
External Wall 1	49.7900	17.9500	31.8400	0.1400	4.4576	14.0000	445.7600	(29a)
External Roof 1	66.4100		66.4100	0.1100	7.3051	9.0000	597.6900	(30)
Total net area of external elements Aum(A, m2)			116.2000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.9443			(33)
Party Wall 1			61.1300	0.0000	0.0000	20.0000	1222.6000	(32)
Wall to corridor			4.2700	0.0000	0.0000	20.0000	85.4000	(32)
Party Floor 1			66.4100			80.0000	5312.8000	(32d)
Internal Wall 1			155.8800			9.0000	1402.9200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 9067.1700	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	136.5332	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	7.7300	0.0500	0.3865
E4 Jamb	46.4000	0.0500	2.3200
E7 Party floor between dwellings (in blocks of flats)	16.5900	0.0700	1.1613
E18 Party wall between dwellings	6.0000	0.0600	0.3600
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	21.8000	0.0000	0.0000
E16 Corner (normal)	6.0000	0.0900	0.5400
E17 Corner (inverted - internal area greater than external area)	3.0000	0.0000	0.0000
E15 Flat roof with parapet	16.5900	0.5600	9.2904
P4 Party wall - Roof (insulation at ceiling level)	21.8000	0.1200	2.6160

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	16.6742	(36)
Point Thermal bridges	(36a) = 0.0000	
Total fabric heat loss	(33) + (36) + (36a) = 50.6185	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	20.1018	20.1018	19.6827	18.4253	18.2157	17.3775	16.9583	16.9583	17.7966	18.8444	19.2635	19.0540	(38)
Heat transfer coeff	70.7203	70.7203	70.3011	69.0437	68.8342	67.9959	67.5768	67.5768	68.4151	69.4629	69.8820	69.6724	(39)
Average = Sum(39)m / 12 =												69.1835	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0649	1.0649	1.0586	1.0397	1.0365	1.0239	1.0176	1.0176	1.0302	1.0460	1.0523	1.0491	(40)
HLP (average)												1.0418	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1559	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	83.0050	81.7576	79.9399	76.4620	73.8955	71.0332	69.4063	71.2103	73.1878	76.2609	79.8135	82.6870	(42a)
Hot water usage for baths	26.0831	25.6958	25.1503	24.1445	23.3913	22.5562	22.1051	22.6468	23.2366	24.1302	25.1567	25.9950	(42b)
Hot water usage for other uses	36.7088	35.3739	34.0390	32.7042	31.3693	30.0344	30.0344	31.3693	32.7042	34.0390	35.3739	36.7088	(42c)
Average daily hot water use (litres/day)												134.0826	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7969	142.8273	139.1292	133.3107	128.6561	123.6239	121.5459	125.2264	129.1285	134.4302	140.3441	145.3907	(44)

Energy conte	230.9067	203.3841	213.8364	182.4956	173.1958	152.0100	146.9993	155.0565	159.2284	182.4205	199.9459	227.6467	(45)
Energy content (annual)										Total = Sum(45)m =		2227.1258	
Distribution loss (46)m = 0.15 x (45)m													
	34.6360	30.5076	32.0755	27.3743	25.9794	22.8015	22.0499	23.2585	23.8843	27.3631	29.9919	34.1470	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
										Total per year (kWh/year) = Sum(64)m =		2474.1578	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
					Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =							0.0000	(64a)
Heat gains from water heating, kWh/month													
	93.5611	82.7855	87.8852	76.9230	74.3722	66.7865	65.6619	68.3409	69.1866	77.4394	82.7252	92.4772	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.7302	19.3006	15.6963	11.8831	8.8827	7.4992	8.1031	10.5328	14.1371	17.9502	20.9506	22.3341	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	281.7577	284.6815	277.3137	261.6285	241.8288	223.2199	210.7880	207.8643	215.2321	230.9172	250.7169	269.3258	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	(71)
Water heating gains (Table 5)													
	125.7542	123.1928	118.1253	106.8375	99.9627	92.7591	88.2552	91.8561	96.0926	104.0853	114.8961	124.2973	(72)
Total internal gains													
	522.4518	520.3846	504.3451	473.5589	443.8841	416.6880	400.3562	403.4629	418.6715	446.1625	479.7734	509.1670	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.1800	10.0309	0.6300	0.8270	0.7700	26.0043	(75)
Southeast	10.7700	33.4622	0.6300	0.8270	0.7700	130.1217	(77)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	156.1260	292.8617	444.0892	624.2330	734.0110	726.4143	701.3537	596.2354	490.8624	328.1960	193.7601	135.6247	(83)
Total gains	678.5779	813.2463	948.4342	1097.7919	1177.8951	1143.1023	1101.7099	999.6983	909.5339	774.3585	673.5335	644.7917	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	35.6144	35.6144	35.8267	36.4792	36.5902	37.0413	37.2711	37.2711	36.8144	36.2591	36.0416	36.1500	
alpha	3.3743	3.3743	3.3884	3.4319	3.4393	3.4694	3.4847	3.4847	3.4543	3.4173	3.4028	3.4100	
util living area													
	0.9321	0.8901	0.8203	0.6944	0.5552	0.4461	0.3665	0.4071	0.5664	0.7788	0.8983	0.9412	(86)
MIT	19.5120	19.8206	20.2127	20.6305	20.8569	20.9466	20.9778	20.9686	20.8806	20.5283	19.9610	19.4490	(87)
Th 2	20.0296	20.0296	20.0348	20.0504	20.0530	20.0635	20.0687	20.0687	20.0582	20.0452	20.0400	20.0426	(88)
util rest of house													
	0.9217	0.8747	0.7975	0.6614	0.5133	0.3973	0.3131	0.3498	0.5131	0.7439	0.8813	0.9321	(89)
MIT 2	18.3240	18.7020	19.1778	19.6740	19.9220	20.0214	20.0540	20.0474	19.9583	19.5706	18.8916	18.2547	(90)
Living area fraction									fLA = Living area / (4) =			0.3439	(91)
MIT	18.7326	19.0867	19.5337	20.0030	20.2436	20.3396	20.3717	20.3643	20.2755	19.9000	19.2594	18.6654	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7326	19.0867	19.5337	20.0030	20.2436	20.3396	20.3717	20.3643	20.2755	19.9000	19.2594	18.6654	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9046	0.8573	0.7844	0.6596	0.5219	0.4119	0.3306	0.3683	0.5258	0.7381	0.8650	0.9158	(94)
Useful gains	613.8382	697.2191	743.9803	724.1350	614.7704	470.8319	364.2490	368.1457	478.2405	571.5522	582.5992	590.4894	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	1048.9631	1045.7213	979.5561	835.6335	656.9225	485.4614	369.7611	376.0144	511.4358	708.5215	884.6639	1042.6767	(97)
Space heating kWh													
	323.7330	234.1935	175.2684	80.2789	31.3612	0.0000	0.0000	0.0000	0.0000	101.9051	217.4866	336.4274	(98a)
Space heating requirement - total per year (kWh/year)												1500.6540	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	323.7330	234.1935	175.2684	80.2789	31.3612	0.0000	0.0000	0.0000	0.0000	101.9051	217.4866	336.4274	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 1500.6540
Space heating per m2 (98c) / (4) = 22.5968 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 100.0000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	323.7330	234.1935	175.2684	80.2789	31.3612	0.0000	0.0000	0.0000	0.0000	101.9051	217.4866	336.4274	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	323.7330	234.1935	175.2684	80.2789	31.3612	0.0000	0.0000	0.0000	0.0000	101.9051	217.4866	336.4274	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	14.4505	13.0520	14.4505	13.9843	14.4505	13.9843	14.4505	14.4505	13.9843	14.4505	13.9843	14.4505	(231)
Lighting	19.0203	15.2588	13.7389	10.0657	7.7750	6.3523	7.0926	9.2193	11.9749	15.7117	17.7464	19.5489	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.7645	-25.1682	-42.6559	-55.4609	-63.6212	-58.9317	-58.4927	-51.6007	-41.8384	-30.3583	-17.5184	-12.6815	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.2242	-5.8944	-14.5880	-27.7797	-40.0352	-40.7711	-40.8407	-31.6711	-21.3640	-9.6436	-3.3502	-1.7465	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year
Space heating fuel - main system 1 1500.6540 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 100.0000
Water heating fuel used 2474.1578 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)
mechanical ventilation fans (SFP = 0.7000) 170.1424 (230a)
Total electricity for the above, kWh/year 170.1424 (231)
Electricity for lighting (calculated in Appendix L) 153.5048 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation -713.0011 (233)
Wind generation 0.0000 (234)
Hydro-electric generation (Appendix N) 0.0000 (235a)
Electricity generated - Micro CHP (Appendix N) 0.0000 (235)
Appendix Q - special features
Energy saved or generated -0.0000 (236)
Energy used 0.0000 (237)
Total delivered energy for all uses 3585.4580 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1500.6540	25.1600	377.5645	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	25.1600	622.4981	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	170.1424	25.1600	42.8078	(249)
Energy for lighting	153.5048	25.1600	38.6218	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-473.0924	25.1600	-119.0300	
PV Unit electricity exported	-239.9087	5.8100	-13.9387	
Total			-132.9687	(252)
Total energy cost			948.5236	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1500.6540	0.1561	234.2123	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2474.1578	0.1413	349.5790	(264)
Space and water heating			583.7913	(265)

Pumps, fans and electric keep-hot	170.1424	0.1387	23.6009	(267)
Energy for lighting	153.5048	0.1443	22.1555	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-473.0924	0.1323	-62.5779	
PV Unit electricity exported	-239.9087	0.1215	-29.1392	
Total			-91.7171	(269)
Total CO2, kg/year			537.8305	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1500.6540	1.5778	2367.7110	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	1.5225	3766.8228	(278)
Space and water heating			6134.5338	(279)
Pumps, fans and electric keep-hot	170.1424	1.5128	257.3915	(281)
Energy for lighting	153.5048	1.5338	235.4508	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-473.0924	1.4887	-704.3146	
PV Unit electricity exported	-239.9087	0.4457	-106.9155	
Total			-811.2300	(283)
Total Primary energy kWh/year			5816.1460	(286)

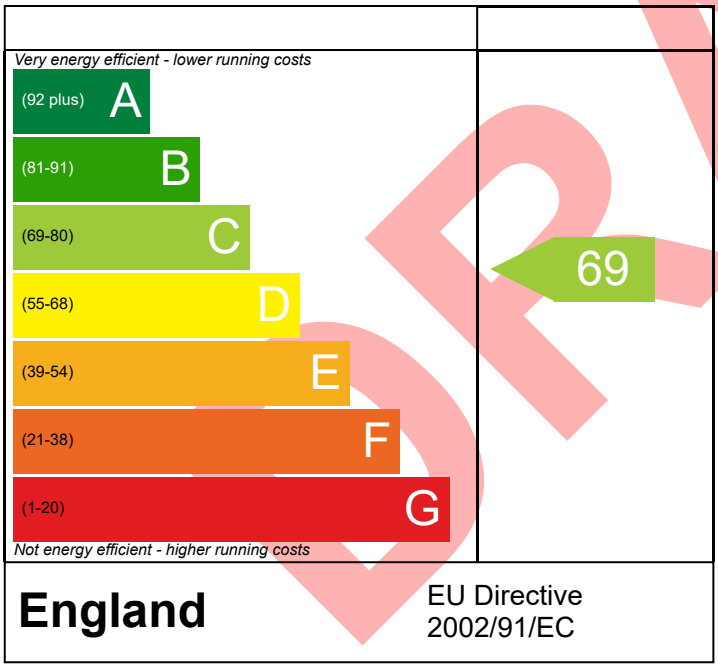
Predicted Energy Assessment

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	66.41 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

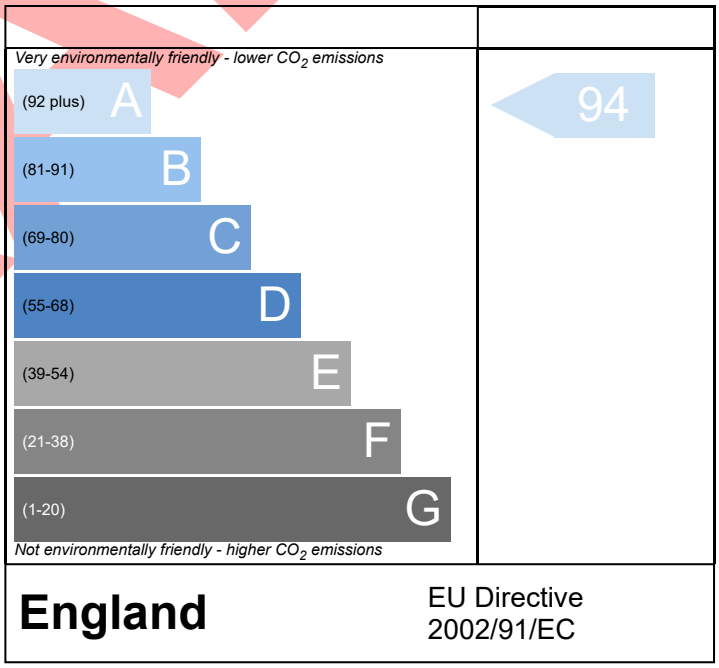
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:44

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	68 m^2
Site Reference	Unit 220 L08_Copy	Plot Reference	Unit 220 L08_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*15.51 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	7.75 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*83.67 kWh_{PE}/m^2*	
Dwelling primary energy	83.95 kWh_{PE}/m^2	FAIL
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*41.6 kWh/m^2*	
Dwelling fabric energy efficiency	39.4 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	30.72	0.14 **(!)**
Party wall: Party Wall (1)	25.8	0 **(!)**
Party wall: Party Wall (2)	24.17	0 **(!)**
Exposed roof: Roof (1)	68.02	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	7.18	South West	0.83	1.3
NW, Opening Type 1	7.18	North West	0.83	1.3
W, Opening Type 1	2.11	West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E15: Flat roof with parapet	Calculated by person with suitable expertise	0.56	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.12	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.88 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 220 L08_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 220 L08_Copy	**Prop Type Ref**	Unit 220 L08
Property			

SAP Rating	70 C	**DER**	7.75	**TER**	15.51
Environmental	94 A	**% DER < TER**			50.03
CO_2 Emissions (t/year)	0.54	**DFEE**	39.42	**TFEE**	41.62
Compliance Check	See BREL	**% DFEE < TFEE**			5.28
% DPER < TPER	-0.33	**DPER**	83.95	**TPER**	83.67

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	68.0200 (1b)	x	3.0000 (2b)	=	204.0600	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.0200					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.0600	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			16.4700	1.2357	20.3527			(27)
External Wall 1	47.1900	16.4700	30.7200	0.1400	4.3008	14.0000	430.0800	(29a)
External Roof 1	68.0200		68.0200	0.1100	7.4822	9.0000	612.1800	(30)
Total net area of external elements Aum(A, m2)			115.2100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.1357			(33)
Party Wall 1			25.8000	0.0000	0.0000	20.0000	516.0000	(32)
Wall to corridor			24.1700	0.0000	0.0000	20.0000	483.4000	(32)
Party Floor 1			68.0200			80.0000	5441.6000	(32d)
Internal Wall 1			142.2000			9.0000	1279.8000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	8763.0600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		128.8306 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	7.1000	0.0500	0.3550

E4 Jamb	41.7600	0.0500	2.0880		
E7 Party floor between dwellings (in blocks of flats)	15.7200	0.0700	1.1004		
E18 Party wall between dwellings	3.0000	0.0600	0.1800		
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.6500	0.0000	0.0000		
E15 Flat roof with parapet	15.7200	0.5600	8.8032		
P4 Party wall - Roof (insulation at ceiling level)	16.6500	0.1200	1.9980		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				14.5246	(36)
Point Thermal bridges			(36a) =	0.0000	
Total fabric heat loss			(33) + (36) + (36a) =	46.6603	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	20.3745	20.1599	19.9452	18.8720	18.6573	17.5841	17.5841	17.3695	18.0134	18.6573	19.0866	19.5159	(38)
Heat transfer coeff	67.0348	66.8201	66.6055	65.5322	65.3176	64.2444	64.2444	64.0297	64.6737	65.3176	65.7469	66.1762	(39)
Average = Sum(39)m / 12 =												65.4786	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9855	0.9824	0.9792	0.9634	0.9603	0.9445	0.9445	0.9413	0.9508	0.9603	0.9666	0.9729	(40)
HLP (average)												0.9626	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.1971	(42)
Hot water usage for mixer showers	83.9547	82.6930	80.8545	77.3369	74.7409	71.8459	70.2004	72.0250	74.0251	77.1335	80.7267	83.6330	(42a)
Hot water usage for baths	26.3801	25.9884	25.4367	24.4194	23.6577	22.8131	22.3569	22.9047	23.5012	24.4050	25.4432	26.2910	(42b)
Hot water usage for other uses	37.1306	35.7804	34.4302	33.0800	31.7298	30.3796	30.3796	31.7298	33.0800	34.4302	35.7804	37.1306	(42c)
Average daily hot water use (litres/day)												135.6171	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	147.4655	144.4618	140.7214	134.8363	130.1284	125.0386	122.9369	126.6595	130.6064	135.9686	141.9503	147.0546	(44)
Energy conte	233.5492	205.7117	216.2835	184.5841	175.1778	153.7496	148.6815	156.8310	161.0507	184.5082	202.2342	230.2520	(45)
Energy content (annual)										Total = Sum(45)m =		2252.6135	
Distribution loss (46)m = 0.15 x (45)m	35.0324	30.8568	32.4425	27.6876	26.2767	23.0624	22.3022	23.5246	24.1576	27.6762	30.3351	34.5378	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	254.5300	224.6621	237.2643	204.8881	196.1586	174.0536	169.6623	177.8118	181.3547	205.4890	222.5382	251.2328	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	254.5300	224.6621	237.2643	204.8881	196.1586	174.0536	169.6623	177.8118	181.3547	205.4890	222.5382	251.2328	(64)
										Total per year (kWh/year) = Sum(64)m =		2499.6455	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	94.4398	83.5595	88.6989	77.6174	75.0313	67.3649	66.2212	68.9309	69.7926	78.1336	83.4861	93.3434	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	131.8267	131.8267	131.8267	131.8267	131.8267	131.8267	131.8267	131.8267	131.8267	131.8267	131.8267	131.8267	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.1739	19.6947	16.0168	12.1257	9.0641	7.6523	8.2686	10.7478	14.4257	18.3168	21.3784	22.7902	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	287.5111	290.4946	282.9763	266.9709	246.7669	227.7780	215.0923	212.1088	219.6270	235.6325	255.8365	274.8254	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.3798	50.3798	50.3798	50.3798	50.3798	50.3798	50.3798	50.3798	50.3798	50.3798	50.3798	50.3798	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-87.8844	-87.8844	-87.8844	-87.8844	-87.8844	-87.8844	-87.8844	-87.8844	-87.8844	-87.8844	-87.8844	-87.8844	(71)
Water heating gains (Table 5)	126.9352	124.3444	119.2190	107.8020	100.8485	93.5624	89.0071	92.6491	96.9341	105.0183	115.9529	125.4616	(72)
Total internal gains	530.9422	528.8557	512.5341	481.2206	451.0015	423.3147	406.6899	409.8278	425.3089	453.2895	487.4897	517.3992	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.1800	36.7938	0.6300	0.8270	0.7700	95.3847	(79)
West	2.1100	19.6403	0.6300	0.8270	0.7700	14.9627	(80)
Northwest	7.1800	11.2829	0.6300	0.8270	0.7700	29.2500	(81)

Solar gains	139.5974	251.2849	377.7806	521.9197	631.4891	646.9523	615.4396	531.0293	427.4845	287.0632	169.7097	117.8210	(83)
Total gains	670.5396	780.1405	890.3147	1003.1403	1082.4906	1070.2670	1022.1295	940.8570	852.7934	740.3527	657.1994	635.2202	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.3123	36.4289	36.5463	37.1448	37.2669	37.8894	37.8894	38.0165	37.6379	37.2669	37.0236	36.7834	
alpha	3.4208	3.4286	3.4364	3.4763	3.4845	3.5260	3.5260	3.5344	3.5092	3.4845	3.4682	3.4522	
util living area	0.9225	0.8797	0.8050	0.6781	0.5256	0.3760	0.2744	0.3095	0.4961	0.7425	0.8839	0.9323	(86)
MIT	19.6549	19.9530	20.3299	20.6953	20.8958	20.9761	20.9940	20.9909	20.9371	20.6492	20.1005	19.5994	(87)
Th 2	20.0954	20.0981	20.1007	20.1139	20.1166	20.1298	20.1298	20.1325	20.1245	20.1166	20.1113	20.1060	(88)
util rest of house	0.9114	0.8638	0.7813	0.6442	0.4831	0.3274	0.2210	0.2525	0.4405	0.7048	0.8658	0.9225	(89)
MIT 2	18.5527	18.9196	19.3746	19.8064	20.0235	20.1128	20.1268	20.1276	20.0759	19.7701	19.1184	18.4918	(90)
Living area fraction										fLA = Living area / (4) =		0.4768	(91)
MIT	19.0782	19.4123	19.8300	20.2302	20.4394	20.5244	20.5403	20.5392	20.4865	20.1892	19.5867	19.0199	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0782	19.4123	19.8300	20.2302	20.4394	20.5244	20.5403	20.5392	20.4865	20.1892	19.5867	19.0199	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8965	0.8500	0.7735	0.6488	0.4989	0.3496	0.2463	0.2794	0.4639	0.7081	0.8536	0.9080	(94)
Useful gains	601.1694	663.1507	688.6757	650.8833	540.0714	374.1439	251.7482	262.8613	395.6485	524.2620	561.0026	576.8081	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	990.6536	969.7126	887.8530	742.4932	570.8356	380.6073	253.1391	265.0302	413.0395	626.3438	820.9586	980.7224	(97)
Space heating kWh	289.7762	206.0096	148.1879	65.9591	22.8885	0.0000	0.0000	0.0000	0.0000	75.9488	187.1683	300.5122	(98a)
Space heating requirement - total per year (kWh/year)												1296.4506	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	289.7762	206.0096	148.1879	65.9591	22.8885	0.0000	0.0000	0.0000	0.0000	75.9488	187.1683	300.5122	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1296.4506	
Space heating per m2											(98c) / (4) =	19.0598	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 100.0000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	289.7762	206.0096	148.1879	65.9591	22.8885	0.0000	0.0000	0.0000	0.0000	75.9488	187.1683	300.5122	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	289.7762	206.0096	148.1879	65.9591	22.8885	0.0000	0.0000	0.0000	0.0000	75.9488	187.1683	300.5122	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	254.5300	224.6621	237.2643	204.8881	196.1586	174.0536	169.6623	177.8118	181.3547	205.4890	222.5382	251.2328	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	254.5300	224.6621	237.2643	204.8881	196.1586	174.0536	169.6623	177.8118	181.3547	205.4890	222.5382	251.2328	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	15.6888	14.1706	15.6888	15.1827	15.6888	15.1827	15.6888	15.6888	15.1827	15.6888	15.1827	15.6888	(231)
Lighting	19.4087	15.5704	14.0194	10.2712	7.9338	6.4820	7.2375	9.4075	12.2194	16.0326	18.1088	19.9481	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.6519	-26.6511	-43.3172	-53.9935	-62.4593	-59.3474	-58.4100	-52.7105	-43.0426	-32.1734	-19.2158	-14.0150	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.7439	-6.5993	-15.2780	-26.7652	-38.7864	-40.6830	-40.1000	-32.4636	-22.1747	-10.9045	-3.9740	-2.0871	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year
Space heating fuel - main system 1 1296.4506 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 100.0000
Water heating fuel used 2499.6455 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)
mechanical ventilation fans (SFP = 0.7420) 184.7233 (230a)
Total electricity for the above, kWh/year 184.7233 (231)
Electricity for lighting (calculated in Appendix L) 156.6394 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation -724.5474 (233)

Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3412.9113	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1296.4506	16.4900	213.7847	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2499.6455	16.4900	412.1915	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	184.7233	16.4900	30.4609	(249)
Energy for lighting	156.6394	16.4900	25.8298	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-481.9878	16.4900	-79.4798	
PV Unit electricity exported	-242.5597	5.5900	-13.5591	
Total			-93.0389	(252)
Total energy cost			589.2281	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.8769	(257)
SAP value	69.5762	
SAP rating (Section 12)	70	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1296.4506	0.1565	202.8962	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2499.6455	0.1413	353.1876	(264)
Space and water heating			556.0837	(265)
Pumps, fans and electric keep-hot	184.7233	0.1387	25.6234	(267)
Energy for lighting	156.6394	0.1443	22.6079	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-481.9878	0.1326	-63.8933	
PV Unit electricity exported	-242.5597	0.1221	-29.6114	
Total			-93.5046	(269)
Total CO2, kg/year			510.8104	(272)
CO2 emissions per m2			7.5100	(273)
EI value			93.9437	
EI rating			94	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		68.0200 (1b)	x	3.0000 (2b)	=	204.0600	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.0200						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.0600	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			16.4700	1.2357	20.3527			(27)
External Wall 1	47.1900	16.4700	30.7200	0.1400	4.3008	14.0000	430.0800	(29a)
External Roof 1	68.0200		68.0200	0.1100	7.4822	9.0000	612.1800	(30)
Total net area of external elements Aum(A, m2)			115.2100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.1357			(33)
Party Wall 1			25.8000	0.0000	0.0000	20.0000	516.0000	(32)
Wall to corridor			24.1700	0.0000	0.0000	20.0000	483.4000	(32)
Party Floor 1			68.0200			80.0000	5441.6000	(32d)
Internal Wall 1			142.2000			9.0000	1279.8000	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 8763.0600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 128.8306 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	7.1000	0.0500	0.3550
E4 Jamb	41.7600	0.0500	2.0880
E7 Party floor between dwellings (in blocks of flats)	15.7200	0.0700	1.1004
E18 Party wall between dwellings	3.0000	0.0600	0.1800
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.6500	0.0000	0.0000
E15 Flat roof with parapet	15.7200	0.5600	8.8032
P4 Party wall - Roof (insulation at ceiling level)	16.6500	0.1200	1.9980

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 14.5246 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 46.6603 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	20.5891	20.5891	20.1599	18.8720	18.6573	17.7988	17.3695	17.3695	18.2280	19.3013	19.7306	19.5159	(38)
Heat transfer coeff	67.2494	67.2494	66.8201	65.5322	65.3176	64.4590	64.0297	64.0297	64.8883	65.9615	66.3908	66.1762	(39)
Average = Sum(39)m / 12 =												65.6753	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9887	0.9887	0.9824	0.9634	0.9603	0.9476	0.9413	0.9413	0.9540	0.9697	0.9760	0.9729	(40)
HLP (average)												0.9655	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1971 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	83.9547	82.6930	80.8545	77.3369	74.7409	71.8459	70.2004	72.0250	74.0251	77.1335	80.7267	83.6330	(42a)
Hot water usage for baths	26.3801	25.9884	25.4367	24.4194	23.6577	22.8131	22.3569	22.9047	23.5012	24.4050	25.4432	26.2910	(42b)
Hot water usage for other uses	37.1306	35.7804	34.4302	33.0800	31.7298	30.3796	30.3796	31.7298	33.0800	34.4302	35.7804	37.1306	(42c)
Average daily hot water use (litres/day)												135.6171	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	147.4655	144.4618	140.7214	134.8363	130.1284	125.0386	122.9369	126.6595	130.6064	135.9686	141.9503	147.0546	(44)
Energy conte	233.5492	205.7117	216.2835	184.5841	175.1778	153.7496	148.6815	156.8310	161.0507	184.5082	202.2342	230.2520	(45)
Energy content (annual)										Total = Sum(45)m =		2252.6135	
Distribution loss (46)m = 0.15 x (45)m	35.0324	30.8568	32.4425	27.6876	26.2767	23.0624	22.3022	23.5246	24.1576	27.6762	30.3351	34.5378	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	254.5300	224.6621	237.2643	204.8881	196.1586	174.0536	169.6623	177.8118	181.3547	205.4890	222.5382	251.2328	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	254.5300	224.6621	237.2643	204.8881	196.1586	174.0536	169.6623	177.8118	181.3547	205.4890	222.5382	251.2328	(64)
										Total per year (kWh/year) = Sum(64)m =		2499.6455	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	94.4398	83.5595	88.6989	77.6174	75.0313	67.3649	66.2212	68.9309	69.7926	78.1336	83.4861	93.3434	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	131.8267	131.8267	131.8267	131.8267	131.8267	131.8267	131.8267	131.8267	131.8267	131.8267	131.8267	131.8267	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	22.1739	19.6947	16.0168	12.1257	9.0641	7.6523	8.2686	10.7478	14.4257	18.3168	21.3784	22.7902	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	287.5111	290.4946	282.9763	266.9709	246.7669	227.7780	215.0923	212.1088	219.6270	235.6325	255.8365	274.8254	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	50.3798	50.3798	50.3798	50.3798	50.3798	50.3798	50.3798	50.3798	50.3798	50.3798	50.3798	50.3798	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-87.8844	-87.8844	-87.8844	-87.8844	-87.8844	-87.8844	-87.8844	-87.8844	-87.8844	-87.8844	-87.8844	-87.8844	(71)

Water heating gains (Table 5)

	126.9352	124.3444	119.2190	107.8020	100.8485	93.5624	89.0071	92.6491	96.9341	105.0183	115.9529	125.4616	(72)

Total internal gains

	530.9422	528.8557	512.5341	481.2206	451.0015	423.3147	406.6899	409.8278	425.3089	453.2895	487.4897	517.3992	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.1800	33.4622	0.6300	0.8270	0.7700	86.7478	(79)
West	2.1100	17.5237	0.6300	0.8270	0.7700	13.3502	(80)
Northwest	7.1800	10.0309	0.6300	0.8270	0.7700	26.0043	(81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	126.1023	241.8769	379.3790	551.2935	661.2500	659.0972	634.4737	531.5388	425.3236	274.4501	157.4741	108.8942	(83)
Total gains	657.0445	770.7326	891.9131	1032.5141	1112.2515	1082.4119	1041.1636	941.3666	850.6325	727.7397	644.9638	626.2934	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.1964	36.1964	36.4289	37.1448	37.2669	37.7633	38.0165	38.0165	37.5134	36.9031	36.6645	36.7834	
alpha	3.4131	3.4131	3.4286	3.4763	3.4845	3.5176	3.5344	3.5344	3.5009	3.4602	3.4443	3.4522	
util living area	0.9307	0.8929	0.8261	0.7003	0.5586	0.4472	0.3677	0.4099	0.5740	0.7850	0.8985	0.9394	(86)
MIT	19.5555	19.8333	20.2144	20.6338	20.8606	20.9491	20.9790	20.9698	20.8811	20.5302	19.9859	19.4998	(87)
Th 2	20.0928	20.0928	20.0981	20.1139	20.1166	20.1272	20.1325	20.1325	20.1219	20.1086	20.1033	20.1060	(88)
util rest of house	0.9208	0.8787	0.8051	0.6695	0.5193	0.4016	0.3178	0.3562	0.5239	0.7527	0.8826	0.9307	(89)
MIT 2	18.4268	18.7681	19.2333	19.7352	19.9862	20.0858	20.1180	20.1112	20.0194	19.6280	18.9723	18.3666	(90)
Living area fraction									fLA = Living area / (4) =			0.4768	(91)
MIT	18.9649	19.2760	19.7011	20.1636	20.4031	20.4974	20.5285	20.5206	20.4302	20.0581	19.4556	18.9069	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9649	19.2760	19.7011	20.1636	20.4031	20.4974	20.5285	20.5206	20.4302	20.0581	19.4556	18.9069	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9059	0.8641	0.7950	0.6713	0.5323	0.4212	0.3408	0.3805	0.5420	0.7507	0.8693	0.9164	(94)
Useful gains	595.2249	665.9580	709.0277	693.0995	592.0176	455.8673	354.8014	358.2156	461.0123	546.3248	560.6434	573.9487	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	1013.1063	1007.1245	942.2354	803.6606	633.7827	470.3840	360.3904	366.2870	495.1128	683.2379	853.4909	1006.3326	(97)
Space heating kWh	310.9038	229.2639	173.5066	79.6040	31.0732	0.0000	0.0000	0.0000	0.0000	101.8633	210.8502	321.6936	(98a)
Space heating requirement - total per year (kWh/year)												1458.7585	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	310.9038	229.2639	173.5066	79.6040	31.0732	0.0000	0.0000	0.0000	0.0000	101.8633	210.8502	321.6936	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1458.7585	
Space heating per m2										(98c) / (4) =		21.4460	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	310.9038	229.2639	173.5066	79.6040	31.0732	0.0000	0.0000	0.0000	0.0000	101.8633	210.8502	321.6936	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	310.9038	229.2639	173.5066	79.6040	31.0732	0.0000	0.0000	0.0000	0.0000	101.8633	210.8502	321.6936	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating

Water heating requirement

	254.5300	224.6621	237.2643	204.8881	196.1586	174.0536	169.6623	177.8118	181.3547	205.4890	222.5382	251.2328	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	254.5300	224.6621	237.2643	204.8881	196.1586	174.0536	169.6623	177.8118	181.3547	205.4890	222.5382	251.2328	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	15.6888	14.1706	15.6888	15.1827	15.6888	15.1827	15.6888	15.6888	15.1827	15.6888	15.1827	15.6888	(231)
Lighting	19.4087	15.5704	14.0194	10.2712	7.9338	6.4820	7.2375	9.4075	12.2194	16.0326	18.1088	19.9481	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.0773	-25.7009	-43.5612	-56.6343	-64.9761	-60.2096	-59.7620	-52.7265	-42.7589	-31.0234	-17.8912	-12.9501	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.3064	-6.0840	-15.0140	-28.5422	-41.0909	-41.8118	-41.8815	-32.4819	-21.9134	-9.9087	-3.4627	-1.8135	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1458.7585	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2499.6455	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	184.7233	(230a)
Total electricity for the above, kWh/year	184.7233	(231)
Electricity for lighting (calculated in Appendix L)	156.6394	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-729.5825	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3570.1841	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1458.7585	25.1600	367.0236	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2499.6455	25.1600	628.9108	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	184.7233	25.1600	46.4764	(249)
Energy for lighting	156.6394	25.1600	39.4105	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-483.2715	25.1600	-121.5911	
PV Unit electricity exported	-246.3110	5.8100	-14.3107	
Total			-135.9018	(252)
Total energy cost			945.9195	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1458.7585	0.1560	227.5189	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2499.6455	0.1413	353.1876	(264)
Space and water heating			580.7065	(265)
Pumps, fans and electric keep-hot	184.7233	0.1387	25.6234	(267)
Energy for lighting	156.6394	0.1443	22.6079	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-483.2715	0.1323	-63.9225	
PV Unit electricity exported	-246.3110	0.1215	-29.9294	
Total			-93.8519	(269)
Total CO2, kg/year			535.0859	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1458.7585	1.5774	2301.0469	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2499.6455	1.5225	3805.6543	(278)
Space and water heating			6106.7013	(279)
Pumps, fans and electric keep-hot	184.7233	1.5128	279.4494	(281)
Energy for lighting	156.6394	1.5338	240.2587	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-483.2715	1.4887	-719.4615	
PV Unit electricity exported	-246.3110	0.4458	-109.8156	
Total			-829.2771	(283)
Total Primary energy kWh/year			5797.1322	(286)

SAP 10 EPC IMPROVEMENTS

Unit 220 L08_Copy

Current energy efficiency rating: C 70
Current environmental impact rating: A 94

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 70
Potential environmental impact rating: A 94

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£1082	£1082	£0
Space heating	£414	£414	£0
Water heating	£629	£629	£0
Lighting	£39	£39	£0
Generated (PV)	-£136	-£136	£0
Total cost of fuels	£946	£946	£0
Total cost of uses	£946	£946	£0
Delivered energy	52 kWh/m²	52 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.5 tonnes	0.0 tonnes
CO2 emissions per m²	8 kg/m²	8 kg/m²	0 kg/m²
Primary energy	85 kWh/m²	85 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	68.0200	(1b)	x 3.0000	(2b) =	204.0600	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.0200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		204.0600	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			16.4700	1.2357	20.3527			(27)
External Wall 1	47.1900	16.4700	30.7200	0.1400	4.3008	14.0000	430.0800	(29a)
External Roof 1	68.0200		68.0200	0.1100	7.4822	9.0000	612.1800	(30)
Total net area of external elements Aum(A, m2)			115.2100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.1357			(33)
Party Wall 1			25.8000	0.0000	0.0000	20.0000	516.0000	(32)
Wall to corridor			24.1700	0.0000	0.0000	20.0000	483.4000	(32)
Party Floor 1			68.0200			80.0000	5441.6000	(32d)
Internal Wall 1			142.2000			9.0000	1279.8000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	8763.0600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		128.8306 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	7.1000	0.0500	0.3550
E4 Jamb	41.7600	0.0500	2.0880
E7 Party floor between dwellings (in blocks of flats)	15.7200	0.0700	1.1004
E18 Party wall between dwellings	3.0000	0.0600	0.1800
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.6500	0.0000	0.0000
E15 Flat roof with parapet	15.7200	0.5600	8.8032
P4 Party wall - Roof (insulation at ceiling level)	16.6500	0.1200	1.9980

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		14.5246 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	46.6603 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	20.3745	20.1599	19.9452	18.8720	18.6573	17.5841	17.5841	17.3695	18.0134	18.6573	19.0866	19.5159	(38)
Heat transfer coeff	67.0348	66.8201	66.6055	65.5322	65.3176	64.2444	64.2444	64.0297	64.6737	65.3176	65.7469	66.1762	(39)
Average = Sum(39)m / 12 =												65.4786	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9855	0.9824	0.9792	0.9634	0.9603	0.9445	0.9445	0.9413	0.9508	0.9603	0.9666	0.9729	(40)
HLP (average)												0.9626	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.1971 (42)
Hot water usage for mixer showers	83.9547	82.6930	80.8545	77.3369	74.7409	71.8459	70.2004	72.0250	74.0251	77.1335	80.7267	83.6330 (42a)
Hot water usage for baths	26.3801	25.9884	25.4367	24.4194	23.6577	22.8131	22.3569	22.9047	23.5012	24.4050	25.4432	26.2910 (42b)
Hot water usage for other uses	37.1306	35.7804	34.4302	33.0800	31.7298	30.3796	30.3796	31.7298	33.0800	34.4302	35.7804	37.1306 (42c)
Average daily hot water use (litres/day)												135.6171 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	147.4655	144.4618	140.7214	134.8363	130.1284	125.0386	122.9369	126.6595	130.6064	135.9686	141.9503	147.0546	(44)
Energy conte	233.5492	205.7117	216.2835	184.5841	175.1778	153.7496	148.6815	156.8310	161.0507	184.5082	202.2342	230.2520	(45)
Energy content (annual)										Total = Sum(45)m =		2252.6135	
Distribution loss (46)m = 0.15 x (45)m	35.0324	30.8568	32.4425	27.6876	26.2767	23.0624	22.3022	23.5246	24.1576	27.6762	30.3351	34.5378	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	254.5300	224.6621	237.2643	204.8881	196.1586	174.0536	169.6623	177.8118	181.3547	205.4890	222.5382	251.2328	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	254.5300	224.6621	237.2643	204.8881	196.1586	174.0536	169.6623	177.8118	181.3547	205.4890	222.5382	251.2328	(64)
										Total per year (kWh/year) = Sum(64)m =		2499.6455	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	94.4398	83.5595	88.6989	77.6174	75.0313	67.3649	66.2212	68.9309	69.7926	78.1336	83.4861	93.3434	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	131.8267	131.8267	131.8267	131.8267	131.8267	131.8267	131.8267	131.8267	131.8267	131.8267	131.8267	131.8267	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.1739	19.6947	16.0168	12.1257	9.0641	7.6523	8.2686	10.7478	14.4257	18.3168	21.3784	22.7902	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	287.5111	290.4946	282.9763	266.9709	246.7669	227.7780	215.0923	212.1088	219.6270	235.6325	255.8365	274.8254	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.3798	50.3798	50.3798	50.3798	50.3798	50.3798	50.3798	50.3798	50.3798	50.3798	50.3798	50.3798	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													

	-87.8844	-87.8844	-87.8844	-87.8844	-87.8844	-87.8844	-87.8844	-87.8844	-87.8844	-87.8844	-87.8844		(71)
Water heating gains (Table 5)													
	126.9352	124.3444	119.2190	107.8020	100.8485	93.5624	89.0071	92.6491	96.9341	105.0183	115.9529	125.4616	(72)
Total internal gains													
	530.9422	528.8557	512.5341	481.2206	451.0015	423.3147	406.6899	409.8278	425.3089	453.2895	487.4897	517.3992	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.1800	36.7938	0.6300	0.8270	0.7700	95.3847	(79)
West	2.1100	19.6403	0.6300	0.8270	0.7700	14.9627	(80)
Northwest	7.1800	11.2829	0.6300	0.8270	0.7700	29.2500	(81)

Solar gains	139.5974	251.2849	377.7806	521.9197	631.4891	646.9523	615.4396	531.0293	427.4845	287.0632	169.7097	117.8210	(83)
Total gains	670.5396	780.1405	890.3147	1003.1403	1082.4906	1070.2670	1022.1295	940.8570	852.7934	740.3527	657.1994	635.2202	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.3123	36.4289	36.5463	37.1448	37.2669	37.8894	37.8894	38.0165	37.6379	37.2669	37.0236	36.7834	
alpha	3.4208	3.4286	3.4364	3.4763	3.4845	3.5260	3.5260	3.5344	3.5092	3.4845	3.4682	3.4522	
util living area													
	0.9225	0.8797	0.8050	0.6781	0.5256	0.3760	0.2744	0.3095	0.4961	0.7425	0.8839	0.9323	(86)
MIT	19.6549	19.9530	20.3299	20.6953	20.8958	20.9761	20.9940	20.9909	20.9371	20.6492	20.1005	19.5994	(87)
Th 2	20.0954	20.0981	20.1007	20.1139	20.1166	20.1298	20.1298	20.1325	20.1245	20.1166	20.1113	20.1060	(88)
util rest of house													
	0.9114	0.8638	0.7813	0.6442	0.4831	0.3274	0.2210	0.2525	0.4405	0.7048	0.8658	0.9225	(89)
MIT 2	18.5527	18.9196	19.3746	19.8064	20.0235	20.1128	20.1268	20.1276	20.0759	19.7701	19.1184	18.4918	(90)
Living area fraction									fLA = Living area / (4) =			0.4768	(91)
MIT	19.0782	19.4123	19.8300	20.2302	20.4394	20.5244	20.5403	20.5392	20.4865	20.1892	19.5867	19.0199	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0782	19.4123	19.8300	20.2302	20.4394	20.5244	20.5403	20.5392	20.4865	20.1892	19.5867	19.0199	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8965	0.8500	0.7735	0.6488	0.4989	0.3496	0.2463	0.2794	0.4639	0.7081	0.8536	0.9080	(94)
Useful gains	601.1694	663.1507	688.6757	650.8833	540.0714	374.1439	251.7482	262.8613	395.6485	524.2620	561.0026	576.8081	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	990.6536	969.7126	887.8530	742.4932	570.8356	380.6073	253.1391	265.0302	413.0395	626.3438	820.9586	980.7224	(97)
Space heating kWh													
	289.7762	206.0096	148.1879	65.9591	22.8885	0.0000	0.0000	0.0000	0.0000	75.9488	187.1683	300.5122	(98a)
Space heating requirement - total per year (kWh/year)												1296.4506	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	289.7762	206.0096	148.1879	65.9591	22.8885	0.0000	0.0000	0.0000	0.0000	75.9488	187.1683	300.5122	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1296.4506	
Space heating per m2											(98c) / (4) =	19.0598	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	289.7762	206.0096	148.1879	65.9591	22.8885	0.0000	0.0000	0.0000	0.0000	75.9488	187.1683	300.5122	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	289.7762	206.0096	148.1879	65.9591	22.8885	0.0000	0.0000	0.0000	0.0000	75.9488	187.1683	300.5122	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	254.5300	224.6621	237.2643	204.8881	196.1586	174.0536	169.6623	177.8118	181.3547	205.4890	222.5382	251.2328	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	254.5300	224.6621	237.2643	204.8881	196.1586	174.0536	169.6623	177.8118	181.3547	205.4890	222.5382	251.2328	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	15.6888	14.1706	15.6888	15.1827	15.6888	15.1827	15.6888	15.6888	15.1827	15.6888	15.1827	15.6888	(231)
Lighting	19.4087	15.5704	14.0194	10.2712	7.9338	6.4820	7.2375	9.4075	12.2194	16.0326	18.1088	19.9481	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.6519	-26.6511	-43.3172	-53.9935	-62.4593	-59.3474	-58.4100	-52.7105	-43.0426	-32.1734	-19.2158	-14.0150	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.7439	-6.5993	-15.2780	-26.7652	-38.7864	-40.6830	-40.1000	-32.4636	-22.1747	-10.9045	-3.9740	-2.0871	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1296.4506	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2499.6455	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	184.7233	(230a)
Total electricity for the above, kWh/year	184.7233	(231)
Electricity for lighting (calculated in Appendix L)	156.6394	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-724.5474	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3412.9113	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1296.4506	16.4900	213.7847	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2499.6455	16.4900	412.1915	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	184.7233	16.4900	30.4609	(249)
Energy for lighting	156.6394	16.4900	25.8298	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-481.9878	16.4900	-79.4798	
PV Unit electricity exported	-242.5597	5.5900	-13.5591	
Total			-93.0389	(252)
Total energy cost			589.2281	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.8769	(257)
SAP value	69.5762	
SAP rating (Section 12)	70	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1296.4506	0.1565	202.8962	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2499.6455	0.1413	353.1876	(264)
Space and water heating			556.0837	(265)
Pumps, fans and electric keep-hot	184.7233	0.1387	25.6234	(267)
Energy for lighting	156.6394	0.1443	22.6079	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-481.9878	0.1326	-63.8933	
PV Unit electricity exported	-242.5597	0.1221	-29.6114	
Total			-93.5046	(269)
Total CO2, kg/year			510.8104	(272)
CO2 emissions per m2			7.5100	(273)
EI value			93.9437	
EI rating			94	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	68.0200	(1b)	x 3.0000	(2b) =	204.0600	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.0200					(4)

Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 204.0600 (5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			16.4700	1.2357	20.3527			(27)
External Wall 1	47.1900	16.4700	30.7200	0.1400	4.3008	14.0000	430.0800	(29a)
External Roof 1	68.0200		68.0200	0.1100	7.4822	9.0000	612.1800	(30)
Total net area of external elements Aum(A, m2)			115.2100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.1357			(33)
Party Wall 1			25.8000	0.0000	0.0000	20.0000	516.0000	(32)
Wall to corridor			24.1700	0.0000	0.0000	20.0000	483.4000	(32)
Party Floor 1			68.0200			80.0000	5441.6000	(32d)
Internal Wall 1			142.2000			9.0000	1279.8000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	8763.0600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		128.8306 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	7.1000	0.0500	0.3550
E2 Other lintels (including other steel lintels)	41.7600	0.0500	2.0880
E4 Jamb	15.7200	0.0700	1.1004
E7 Party floor between dwellings (in blocks of flats)	3.0000	0.0600	0.1800
E18 Party wall between dwellings	16.6500	0.0000	0.0000
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	15.7200	0.5600	8.8032
E15 Flat roof with parapet	16.6500	0.1200	1.9980
P4 Party wall - Roof (insulation at ceiling level)			

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		14.5246 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	46.6603 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	20.5891	20.5891	20.1599	18.8720	18.6573	17.7988	17.3695	17.3695	18.2280	19.3013	19.7306	19.5159	(38)
Heat transfer coeff	67.2494	67.2494	66.8201	65.5322	65.3176	64.4590	64.0297	64.0297	64.8883	65.9615	66.3908	66.1762	(39)
Average = Sum(39)m / 12 =												65.6753	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9887	0.9887	0.9824	0.9634	0.9603	0.9476	0.9413	0.9413	0.9540	0.9697	0.9760	0.9729	(40)
HLP (average)												0.9655	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1971	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
83.9547	82.6930	80.8545	77.3369	74.7409	71.8459	70.2004	72.0250	74.0251	77.1335	80.7267	83.6330	(42a)

Hot water usage for baths

26.3801	25.9884	25.4367	24.4194	23.6577	22.8131	22.3569	22.9047	23.5012	24.4050	25.4432	26.2910	(42b)

Hot water usage for other uses

37.1306	35.7804	34.4302	33.0800	31.7298	30.3796	30.3796	31.7298	33.0800	34.4302	35.7804	37.1306	(42c)
Average daily hot water use (litres/day)											135.6171	(43)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	147.4655	144.4618	140.7214	134.8363	130.1284	125.0386	122.9369	126.6595	130.6064	135.9686	141.9503	147.0546	(44)
Energy conte	233.5492	205.7117	216.2835	184.5841	175.1778	153.7496	148.6815	156.8310	161.0507	184.5082	202.2342	230.2520	(45)
Energy content (annual)										Total = Sum(45)m =		2252.6135	
Distribution loss (46)m = 0.15 x (45)m	35.0324	30.8568	32.4425	27.6876	26.2767	23.0624	22.3022	23.5246	24.1576	27.6762	30.3351	34.5378	(46)
Water storage loss:													

Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	254.5300	224.6621	237.2643	204.8881	196.1586	174.0536	169.6623	177.8118	181.3547	205.4890	222.5382	251.2328	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	254.5300	224.6621	237.2643	204.8881	196.1586	174.0536	169.6623	177.8118	181.3547	205.4890	222.5382	251.2328	(64)
										Total per year (kWh/year) = Sum(64)m =		2499.6455	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	94.4398	83.5595	88.6989	77.6174	75.0313	67.3649	66.2212	68.9309	69.7926	78.1336	83.4861	93.3434	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	131.8267	131.8267	131.8267	131.8267	131.8267	131.8267	131.8267	131.8267	131.8267	131.8267	131.8267	131.8267	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.1739	19.6947	16.0168	12.1257	9.0641	7.6523	8.2686	10.7478	14.4257	18.3168	21.3784	22.7902	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	287.5111	290.4946	282.9763	266.9709	246.7669	227.7780	215.0923	212.1088	219.6270	235.6325	255.8365	274.8254	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.3798	50.3798	50.3798	50.3798	50.3798	50.3798	50.3798	50.3798	50.3798	50.3798	50.3798	50.3798	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-87.8844	-87.8844	-87.8844	-87.8844	-87.8844	-87.8844	-87.8844	-87.8844	-87.8844	-87.8844	-87.8844	-87.8844	(71)
Water heating gains (Table 5)													
	126.9352	124.3444	119.2190	107.8020	100.8485	93.5624	89.0071	92.6491	96.9341	105.0183	115.9529	125.4616	(72)
Total internal gains													
	530.9422	528.8557	512.5341	481.2206	451.0015	423.3147	406.6899	409.8278	425.3089	453.2895	487.4897	517.3992	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.1800	33.4622	0.6300	0.8270	0.7700	86.7478	(79)
West	2.1100	17.5237	0.6300	0.8270	0.7700	13.3502	(80)
Northwest	7.1800	10.0309	0.6300	0.8270	0.7700	26.0043	(81)

Solar gains	126.1023	241.8769	379.3790	551.2935	661.2500	659.0972	634.4737	531.5388	425.3236	274.4501	157.4741	108.8942	(83)
Total gains	657.0445	770.7326	891.9131	1032.5141	1112.2515	1082.4119	1041.1636	941.3666	850.6325	727.7397	644.9638	626.2934	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.1964	36.1964	36.4289	37.1448	37.2669	37.7633	38.0165	38.0165	37.5134	36.9031	36.6645	36.7834	
alpha	3.4131	3.4131	3.4286	3.4763	3.4845	3.5176	3.5344	3.5344	3.5009	3.4602	3.4443	3.4522	
util living area													
	0.9307	0.8929	0.8261	0.7003	0.5586	0.4472	0.3677	0.4099	0.5740	0.7850	0.8985	0.9394	(86)
MIT	19.5555	19.8333	20.2144	20.6338	20.8606	20.9491	20.9790	20.9698	20.8811	20.5302	19.9859	19.4998	(87)
Th 2	20.0928	20.0928	20.0981	20.1139	20.1166	20.1272	20.1325	20.1325	20.1219	20.1086	20.1033	20.1060	(88)
util rest of house													
	0.9208	0.8787	0.8051	0.6695	0.5193	0.4016	0.3178	0.3562	0.5239	0.7527	0.8826	0.9307	(89)
MIT 2	18.4268	18.7681	19.2333	19.7352	19.9862	20.0858	20.1180	20.1112	20.0194	19.6280	18.9723	18.3666	(90)
Living area fraction										fLA = Living area / (4) =		0.4768	(91)
MIT	18.9649	19.2760	19.7011	20.1636	20.4031	20.4974	20.5285	20.5206	20.4302	20.0581	19.4556	18.9069	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9649	19.2760	19.7011	20.1636	20.4031	20.4974	20.5285	20.5206	20.4302	20.0581	19.4556	18.9069	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9059	0.8641	0.7950	0.6713	0.5323	0.4212	0.3408	0.3805	0.5420	0.7507	0.8693	0.9164	(94)
Useful gains	595.2249	665.9580	709.0277	693.0995	592.0176	455.8673	354.8014	358.2156	461.0123	546.3248	560.6434	573.9487	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	1013.1063	1007.1245	942.2354	803.6606	633.7827	470.3840	360.3904	366.2870	495.1128	683.2379	853.4909	1006.3326	(97)
Space heating kWh													
	310.9038	229.2639	173.5066	79.6040	31.0732	0.0000	0.0000	0.0000	0.0000	101.8633	210.8502	321.6936	(98a)
Space heating requirement - total per year (kWh/year)												1458.7585	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	310.9038	229.2639	173.5066	79.6040	31.0732	0.0000	0.0000	0.0000	0.0000	101.8633	210.8502	321.6936	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1458.7585	
Space heating per m2											(98c) / (4) =	21.4460	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	310.9038	229.2639	173.5066	79.6040	31.0732	0.0000	0.0000	0.0000	0.0000	101.8633	210.8502	321.6936	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	310.9038	229.2639	173.5066	79.6040	31.0732	0.0000	0.0000	0.0000	0.0000	101.8633	210.8502	321.6936	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	254.5300	224.6621	237.2643	204.8881	196.1586	174.0536	169.6623	177.8118	181.3547	205.4890	222.5382	251.2328	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	254.5300	224.6621	237.2643	204.8881	196.1586	174.0536	169.6623	177.8118	181.3547	205.4890	222.5382	251.2328	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	15.6888	14.1706	15.6888	15.1827	15.6888	15.1827	15.6888	15.6888	15.1827	15.6888	15.1827	15.6888	(231)
Lighting	19.4087	15.5704	14.0194	10.2712	7.9338	6.4820	7.2375	9.4075	12.2194	16.0326	18.1088	19.9481	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.0773	-25.7009	-43.5612	-56.6343	-64.9761	-60.2096	-59.7620	-52.7265	-42.7589	-31.0234	-17.8912	-12.9501	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.3064	-6.0840	-15.0140	-28.5422	-41.0909	-41.8118	-41.8815	-32.4819	-21.9134	-9.9087	-3.4627	-1.8135	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1458.7585	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2499.6455	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)													
mechanical ventilation fans (SFP = 0.7420)												184.7233	(230a)
Total electricity for the above, kWh/year												184.7233	(231)
Electricity for lighting (calculated in Appendix L)												156.6394	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-729.5825	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3570.1841	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1458.7585	25.1600	367.0236	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2499.6455	25.1600	628.9108	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	184.7233	25.1600	46.4764	(249)
Energy for lighting	156.6394	25.1600	39.4105	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-483.2715	25.1600	-121.5911	
PV Unit electricity exported	-246.3110	5.8100	-14.3107	
Total			-135.9018	(252)
Total energy cost			945.9195	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1458.7585	0.1560	227.5189	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2499.6455	0.1413	353.1876	(264)
Space and water heating			580.7065	(265)
Pumps, fans and electric keep-hot	184.7233	0.1387	25.6234	(267)
Energy for lighting	156.6394	0.1443	22.6079	(268)
Energy saving/generation technologies				

PV Unit electricity used in dwelling	-483.2715	0.1323	-63.9225	
PV Unit electricity exported	-246.3110	0.1215	-29.9294	
Total			-93.8519	(269)
Total CO2, kg/year			535.0859	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1458.7585	1.5774	2301.0469	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2499.6455	1.5225	3805.6543	(278)
Space and water heating			6106.7013	(279)
Pumps, fans and electric keep-hot	184.7233	1.5128	279.4494	(281)
Energy for lighting	156.6394	1.5338	240.2587	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-483.2715	1.4887	-719.4615	
PV Unit electricity exported	-246.3110	0.4458	-109.8156	
Total			-829.2771	(283)
Total Primary energy kWh/year			5797.1322	(286)

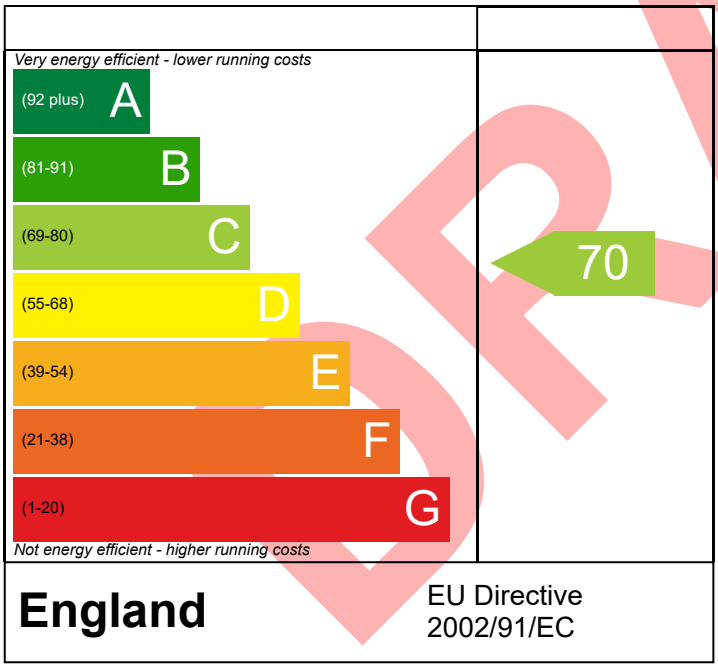
Predicted Energy Assessment

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	68.02 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

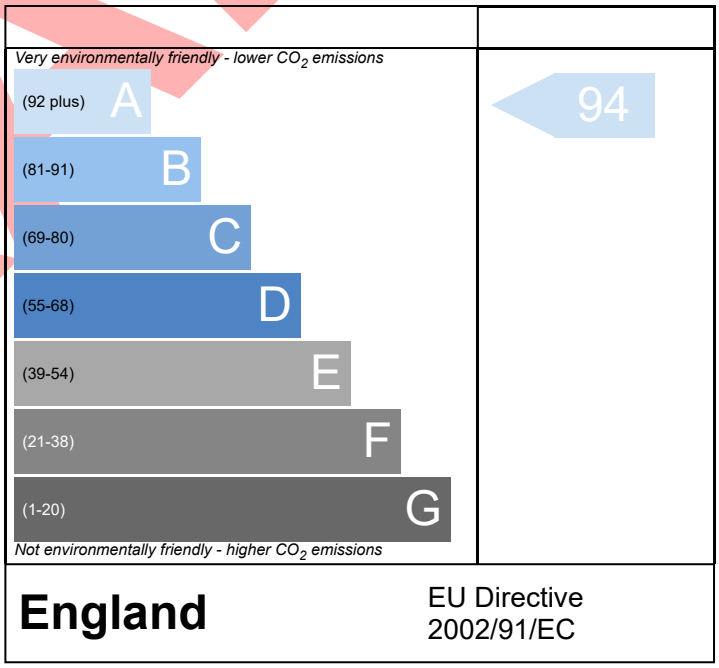
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:44

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	36 m^2
Site Reference	Unit 272 MEZ_Copy	Plot Reference	Unit 272 MEZ_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*24.2 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	11.42 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*131.38 kWh$_{PE}$/m^2*	
Dwelling primary energy	122.49 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*65.6 kWh/m^2*	
Dwelling fabric energy efficiency	59.1 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.12	Heatloss Floor 1 (0.12)	OK
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	23.79	0.14 **(!)**
Exposed wall: Walls (2)	34.25	0.14 **(!)**
Party wall: Party Wall (1)	34.22	0 **(!)**
Party wall: Party Wall (2)	27.42	0 **(!)**
Ground floor: Heatloss Floor 1, Heatloss Floor 1	35.93	0.12

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	5.69	North East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E3: Sill	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.16	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.08	
Party wall	P2: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0 **(!)**	
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.46 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 272 MEZ_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 272 MEZ_Copy	**Prop Type Ref**	Unit 272 MEZ
Property			

SAP Rating	67 D	**DER**	11.42	**TER**	24.20
Environmental	93 A	**% DER < TER**			52.81
CO_2 Emissions (t/year)	0.41	**DFEE**	59.13	**TFEE**	65.63
Compliance Check	See BREL	**% DFEE < TFEE**			9.90
% DPER < TPER	6.76	**DPER**	122.49	**TPER**	131.38

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	35.9300	(1b)	x 4.7500	(2b)	= 170.6675	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	35.9300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)		= 170.6675	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			5.6900	1.2357	7.0314			(27)
Heatloss Floor 1			35.9300	0.1200	4.3116	75.0000	2694.7500	(28a)
External Wall 1	29.4800	5.6900	23.7900	0.1400	3.3306	14.0000	333.0600	(29a)
Wall to Unheated Bike Store	34.2500		34.2500	0.1400	4.7950	14.0000	479.5000	(29a)
Total net area of external elements Aum(A, m2)			99.6600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	19.4686			(33)
Party Wall 1			34.2200	0.0000	0.0000	20.0000	684.4000	(32)
Wall to corridor			27.4200	0.0000	0.0000	20.0000	548.4000	(32)
Party Ceiling 1			35.9300			80.0000	2874.4000	(32b)
Internal Wall 1			103.4900			9.0000	931.4100	(32c)
Internal Floor 1			21.1000			0.0000	0.0000	(32d)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	8545.9200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		237.8492 (35)
List of Thermal Bridges		

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	2.4400	0.0500	0.1220	
E3 Sill	2.4400	0.0500	0.1220	
E4 Jamb	9.3000	0.0500	0.4650	
E5 Ground floor (normal)	12.3700	0.1600	1.9792	
E18 Party wall between dwellings	5.1500	0.0600	0.3090	
P1 Party wall - Ground floor	11.9700	0.0800	0.9576	
P2 Party wall - Intermediate floor within a dwelling	9.2800	0.0000	0.0000	
E6 Intermediate floor within a dwelling	6.5500	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			3.9548	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	23.4234	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.2326	16.0689	15.9052	15.0868	14.9231	14.1047	14.1047	13.9410	14.4321	14.9231	15.2505	15.5778	(38)
Heat transfer coeff	39.6559	39.4922	39.3286	38.5102	38.3465	37.5281	37.5281	37.3644	37.8554	38.3465	38.6738	39.0012	(39)
Average = Sum(39)m / 12 =												38.4692	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1037	1.0991	1.0946	1.0718	1.0673	1.0445	1.0445	1.0399	1.0536	1.0673	1.0764	1.0855	(40)
HLP (average)												1.0707	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy											1.3029	(42)
Hot water usage for mixer showers	81.2374	80.0165	78.2375	74.8337	72.3218	69.5205	67.9283	69.6938	71.6292	74.6369	78.1138	80.9261	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	27.9726	26.9554	25.9383	24.9211	23.9039	22.8867	22.8867	23.9039	24.9211	25.9383	26.9554	27.9726	(42c)
Average daily hot water use (litres/day)												100.3278	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.2100	106.9720	104.1758	99.7548	96.2257	92.4072	90.8150	93.5977	96.5503	100.5752	105.0693	108.8987	(44)
Energy conte	172.9619	152.3267	160.1143	136.5593	129.5383	113.6255	109.8329	115.8935	119.0561	136.4795	149.6904	170.5091	(45)
Energy content (annual)										Total = Sum(45)m =		1666.5875	
Distribution loss (46)m = 0.15 x (45)m	25.9443	22.8490	24.0171	20.4839	19.4307	17.0438	16.4749	17.3840	17.8584	20.4719	22.4536	25.5764	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(64)
										Total per year (kWh/year) = Sum(64)m =		1913.6195	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	74.2945	65.8089	70.0226	61.6492	59.8561	54.0237	53.3041	55.3192	55.8294	62.1641	66.0153	73.4789	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.2890	11.8032	9.5990	7.2670	5.4322	4.5861	4.9554	6.4413	8.6455	10.9774	12.8122	13.6583	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	166.3438	168.0699	163.7201	154.4599	142.7706	131.7843	124.4448	122.7187	127.0684	136.3286	148.0179	159.0042	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	(71)
Water heating gains (Table 5)	99.8582	97.9300	94.1165	85.6239	80.4518	75.0329	71.6452	74.3538	77.5408	83.5539	91.6879	98.7620	(72)
Total internal gains	349.6683	347.9804	337.6129	317.5282	298.8319	281.5806	271.2228	273.6911	283.4320	301.0372	322.6954	341.6019	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.6900	11.2829	0.6300	0.8270	0.7700	23.1800	(75)

Solar gains	23.1800	47.1836	85.0099	139.6106	187.6641	200.0697	187.1611	149.2070	103.5858	57.6621	29.1665	18.9300	(83)
Total gains	372.8483	395.1640	422.6227	457.1388	486.4960	481.6503	458.3839	422.8981	387.0178	358.6993	351.8618	360.5319	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8616	60.1097	60.3599	61.6426	61.9057	63.2557	63.2557	63.5329	62.7087	61.9057	61.3817	60.8665	
alpha	4.9908	5.0073	5.0240	5.1095	5.1270	5.2170	5.2170	5.2355	5.1806	5.1270	5.0921	5.0578	
util living area	0.9743	0.9629	0.9312	0.8442	0.6862	0.4919	0.3591	0.4043	0.6435	0.8777	0.9568	0.9775	(86)
MIT	20.0642	20.2001	20.4459	20.7479	20.9282	20.9898	20.9984	20.9971	20.9616	20.7353	20.3679	20.0489	(87)
Th 2	19.9978	20.0015	20.0053	20.0239	20.0277	20.0464	20.0464	20.0502	20.0389	20.0277	20.0202	20.0127	(88)
util rest of house	0.9674	0.9531	0.9133	0.8080	0.6282	0.4216	0.2819	0.3219	0.5658	0.8400	0.9438	0.9714	(89)
MIT 2	18.9462	19.1180	19.4212	19.7854	19.9722	20.0409	20.0459	20.0492	20.0152	19.7842	19.3435	18.9386	(90)
Living area fraction										fLA = Living area / (4) =		0.7762	(91)
MIT	19.8140	19.9580	20.2166	20.5325	20.7143	20.7774	20.7852	20.7850	20.7498	20.5225	20.1386	19.8004	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8140	19.9580	20.2166	20.5325	20.7143	20.7774	20.7852	20.7850	20.7498	20.5225	20.1386	19.8004	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9659	0.9526	0.9175	0.8277	0.6698	0.4758	0.3418	0.3858	0.6241	0.8604	0.9456	0.9699	(94)
Useful gains	360.1523	376.4296	387.7545	378.3888	325.8786	229.1488	156.6771	163.1395	241.5390	308.6366	332.7047	349.6635	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	615.2221	594.6729	539.4548	447.9705	345.6668	231.8276	157.0641	163.8421	251.7323	380.4928	504.2540	608.4346	(97)
Space heating kWh	189.7719	146.6595	112.8650	50.0989	14.7224	0.0000	0.0000	0.0000	0.0000	53.4610	123.5155	192.5257	(98a)
Space heating requirement - total per year (kWh/year)												883.6199	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	189.7719	146.6595	112.8650	50.0989	14.7224	0.0000	0.0000	0.0000	0.0000	53.4610	123.5155	192.5257	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												883.6199	
Space heating per m2											(98c) / (4) =	24.5928	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 100.0000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	189.7719	146.6595	112.8650	50.0989	14.7224	0.0000	0.0000	0.0000	0.0000	53.4610	123.5155	192.5257	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	189.7719	146.6595	112.8650	50.0989	14.7224	0.0000	0.0000	0.0000	0.0000	53.4610	123.5155	192.5257	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.1215	11.8517	13.1215	12.6982	13.1215	12.6982	13.1215	13.1215	12.6982	13.1215	12.6982	13.1215	(231)
Lighting	11.6318	9.3314	8.4019	6.1556	4.7548	3.8847	4.3375	5.6380	7.3232	9.6084	10.8527	11.9551	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-8.8687	-14.3525	-23.6272	-29.8127	-34.7626	-33.2468	-32.7381	-29.3867	-23.7830	-17.4874	-10.2856	-7.4485	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.2701	-3.0283	-7.0021	-12.4021	-18.1612	-19.0419	-18.7557	-15.1361	-10.3078	-5.0306	-1.8364	-0.9686	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 883.6199 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 100.0000

Water heating fuel used 1913.6195 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)

mechanical ventilation fans (SFP = 0.7420) 154.4950 (230a)

Total electricity for the above, kWh/year 154.4950 (231)

Electricity for lighting (calculated in Appendix L) 93.8751 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	-378.7407	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2666.8689	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	883.6199	16.4900	145.7089	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1913.6195	16.4900	315.5559	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	154.4950	16.4900	25.4762	(249)
Energy for lighting	93.8751	16.4900	15.4800	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-265.7998	16.4900	-43.8304	
PV Unit electricity exported	-112.9409	5.5900	-6.3134	
Total			-50.1438	(252)
Total energy cost			452.0773	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	2.0110	(257)
SAP value		67.4022	
SAP rating (Section 12)		67	(258)
SAP band		D	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	883.6199	0.1563	138.0774	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1913.6195	0.1412	270.2448	(264)
Space and water heating			408.3223	(265)
Pumps, fans and electric keep-hot	154.4950	0.1387	21.4304	(267)
Energy for lighting	93.8751	0.1443	13.5491	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-265.7998	0.1323	-35.1707	
PV Unit electricity exported	-112.9409	0.1219	-13.7709	
Total			-48.9416	(269)
Total CO2, kg/year			394.3601	(272)
CO2 emissions per m2			10.9800	(273)
EI value			93.4704	
EI rating			93	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		35.9300 (1b)	x	4.7500 (2b)	=	170.6675	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	35.9300						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.6675	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)

Infiltration rate												0.1500	(18)
Number of sides sheltered												3	(19)
Shelter factor								(20) = 1 - [0.075 x (19)] =				0.7750	(20)
Infiltration rate adjusted to include shelter factor								(21) = (18) x (20) =				0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery		
If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			5.6900	1.2357	7.0314			(27)
Heatloss Floor 1			35.9300	0.1200	4.3116	75.0000	2694.7500	(28a)
External Wall 1	29.4800	5.6900	23.7900	0.1400	3.3306	14.0000	333.0600	(29a)
Wall to Unheated Bike Store	34.2500		34.2500	0.1400	4.7950	14.0000	479.5000	(29a)
Total net area of external elements Aum(A, m2)			99.6600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		19.4686			(33)
Party Wall 1			34.2200	0.0000	0.0000	20.0000	684.4000	(32)
Wall to corridor			27.4200	0.0000	0.0000	20.0000	548.4000	(32)
Party Ceiling 1			35.9300			80.0000	2874.4000	(32b)
Internal Wall 1			103.4900			9.0000	931.4100	(32c)
Internal Floor 1			21.1000			0.0000	0.0000	(32d)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 8545.9200	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	237.8492	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.4400	0.0500	0.1220
E3 Sill	2.4400	0.0500	0.1220
E4 Jamb	9.3000	0.0500	0.4650
E5 Ground floor (normal)	12.3700	0.1600	1.9792
E18 Party wall between dwellings	5.1500	0.0600	0.3090
P1 Party wall - Ground floor	11.9700	0.0800	0.9576
P2 Party wall - Intermediate floor within a dwelling	9.2800	0.0000	0.0000
E6 Intermediate floor within a dwelling	6.6500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	3.9548	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	23.4234	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3962	16.3962	16.0689	15.0868	14.9231	14.2684	13.9410	13.9410	14.5958	15.4142	15.7415	15.5778	(38)
Heat transfer coeff	39.8196	39.8196	39.4922	38.5102	38.3465	37.6918	37.3644	37.3644	38.0191	38.8375	39.1649	39.0012	(39)
Average = Sum(39)m / 12 =												38.6193	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1083	1.1083	1.0991	1.0718	1.0673	1.0490	1.0399	1.0399	1.0581	1.0809	1.0900	1.0855	(40)
HLP (average)												1.0748	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.3029	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	81.2374	80.0165	78.2375	74.8337	72.3218	69.5205	67.9283	69.6938	71.6292	74.6369	78.1138	80.9261	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	27.9726	26.9554	25.9383	24.9211	23.9039	22.8867	22.8867	23.9039	24.9211	25.9383	26.9554	27.9726	(42c)
Average daily hot water use (litres/day)												100.3278	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.2100	106.9720	104.1758	99.7548	96.2257	92.4072	90.8150	93.5977	96.5503	100.5752	105.0693	108.8987	(44)
Energy conte	172.9619	152.3267	160.1143	136.5593	129.5383	113.6255	109.8329	115.8935	119.0561	136.4795	149.6904	170.5091	(45)
Energy content (annual)										Total = Sum(45)m =		1666.5875	
Distribution loss (46)m = 0.15 x (45)m	25.9443	22.8490	24.0171	20.4839	19.4307	17.0438	16.4749	17.3840	17.8584	20.4719	22.4536	25.5764	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(64)
										Total per year (kWh/year) = Sum(64)m =		1913.6195	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

	74.2945	65.8089	70.0226	61.6492	59.8561	54.0237	53.3041	55.3192	55.8294	62.1641	66.0153	73.4789 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	13.2890	11.8032	9.5990	7.2670	5.4322	4.5861	4.9554	6.4413	8.6455	10.9774	12.8122	13.6583	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	166.3438	168.0699	163.7201	154.4599	142.7706	131.7843	124.4448	122.7187	127.0684	136.3286	148.0179	159.0042	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	(71)

Water heating gains (Table 5)

	99.8582	97.9300	94.1165	85.6239	80.4518	75.0329	71.6452	74.3538	77.5408	83.5539	91.6879	98.7620	(72)

Total internal gains

	349.6683	347.9804	337.6129	317.5282	298.8319	281.5806	271.2228	273.6911	283.4320	301.0372	322.6954	341.6019	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.6900	10.0309	0.6300	0.8270	0.7700	20.6078	(75)

Solar gains	20.6078	44.6153	83.8589	145.3011	194.3041	201.8896	190.9713	147.3724	101.3317	54.1341	26.6175	17.2319	(83)
Total gains	370.2761	392.5957	421.4717	462.8292	493.1360	483.4702	462.1941	421.0634	384.7637	355.1713	349.3129	358.8338	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.6155	59.6155	60.1097	61.6426	61.9057	62.9811	63.5329	63.5329	62.4388	61.1230	60.6121	60.8665	
alpha	4.9744	4.9744	5.0073	5.1095	5.1270	5.1987	5.2355	5.2355	5.1626	5.0749	5.0408	5.0578	
util living area	0.9774	0.9689	0.9450	0.8701	0.7322	0.5893	0.4869	0.5391	0.7388	0.9099	0.9640	0.9804	(86)
MIT	20.0023	20.1099	20.3424	20.6795	20.8932	20.9712	20.9909	20.9852	20.9132	20.6363	20.2868	19.9856	(87)
Th 2	19.9941	19.9941	20.0015	20.0239	20.0277	20.0427	20.0502	20.0502	20.0352	20.0164	20.0090	20.0127	(88)
util rest of house	0.9713	0.9607	0.9308	0.8400	0.6807	0.5238	0.4139	0.4613	0.6737	0.8814	0.9531	0.9752	(89)
MIT 2	18.8656	18.9999	19.2923	19.7081	19.9386	20.0237	20.0455	20.0423	19.9708	19.6629	19.2349	18.8588	(90)
Living area fraction										fLA = Living area / (4) =		0.7762	(91)
MIT	19.7479	19.8615	20.1074	20.4622	20.6796	20.7592	20.7793	20.7742	20.7024	20.4185	20.0514	19.7335	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7479	19.8615	20.1074	20.4622	20.6796	20.7592	20.7793	20.7742	20.7024	20.4185	20.0514	19.7335	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9696	0.9595	0.9325	0.8543	0.7160	0.5732	0.4702	0.5210	0.7198	0.8940	0.9537	0.9734	(94)
Useful gains	359.0224	376.6959	393.0222	395.3719	353.0609	277.1382	217.3077	219.3664	276.9708	317.5265	333.1270	349.2892	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	631.0589	619.6534	572.9308	483.7706	382.6815	284.9193	219.6772	223.2224	300.4407	416.2797	526.8241	625.3249	(97)
Space heating kWh	202.3952	163.2674	133.8520	63.6471	22.0377	0.0000	0.0000	0.0000	0.0000	73.4723	139.4619	205.3705	(98a)
Space heating requirement - total per year (kWh/year)												1003.5041	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	202.3952	163.2674	133.8520	63.6471	22.0377	0.0000	0.0000	0.0000	0.0000	73.4723	139.4619	205.3705	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1003.5041	
Space heating per m2											(98c) / (4) =	27.9294	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	202.3952	163.2674	133.8520	63.6471	22.0377	0.0000	0.0000	0.0000	0.0000	73.4723	139.4619	205.3705	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	202.3952	163.2674	133.8520	63.6471	22.0377	0.0000	0.0000	0.0000	0.0000	73.4723	139.4619	205.3705	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating
Water heating requirement

	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	13.1215	11.8517	13.1215	12.6982	13.1215	12.6982	13.1215	13.1215	12.6982	13.1215	12.6982	13.1215 (231)
Lighting	11.6318	9.3314	8.4019	6.1556	4.7548	3.8847	4.3375	5.6380	7.3232	9.6084	10.8527	11.9551 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-8.0185	-13.8258	-23.7611	-31.3571	-36.2395	-33.7534	-33.5336	-29.3960	-23.6207	-16.8408	-9.5629	-6.8751 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-1.0684	-2.7891	-6.8577	-13.1670	-19.2047	-19.5759	-19.5982	-15.1448	-10.1853	-4.5556	-1.5993	-0.8422 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year

Space heating fuel - main system 1	1003.5041 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	1913.6195 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	154.4950 (230a)
Total electricity for the above, kWh/year	154.4950 (231)
Electricity for lighting (calculated in Appendix L)	93.8751 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-381.3727 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2784.1212 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1003.5041	25.1600	252.4816	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1913.6195	25.1600	481.4667	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	154.4950	25.1600	38.8710	(249)
Energy for lighting	93.8751	25.1600	23.6190	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-266.7845	25.1600	-67.1230	
PV Unit electricity exported	-114.5882	5.8100	-6.6576	
Total			-73.7805	(252)
Total energy cost			722.6577	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1003.5041	0.1556	156.1294	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1913.6195	0.1412	270.2448	(264)
Space and water heating			426.3743	(265)
Pumps, fans and electric keep-hot	154.4950	0.1387	21.4304	(267)
Energy for lighting	93.8751	0.1443	13.5491	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-266.7845	0.1320	-35.2240	
PV Unit electricity exported	-114.5882	0.1213	-13.9032	
Total			-49.1272	(269)
Total CO2, kg/year			412.2266	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1003.5041	1.5760	1581.5504	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1913.6195	1.5222	2912.9178	(278)
Space and water heating			4494.4683	(279)
Pumps, fans and electric keep-hot	154.4950	1.5128	233.7201	(281)
Energy for lighting	93.8751	1.5338	143.9888	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-266.7845	1.4878	-396.9312	
PV Unit electricity exported	-114.5882	0.4452	-51.0109	
Total			-447.9421	(283)
Total Primary energy kWh/year			4424.2351	(286)

SAP 10 EPC IMPROVEMENTS

Unit 272 MEZ_Copy

Current energy efficiency rating: D 67
Current environmental impact rating: A 93

N Solar water heating — Not applicable
U Solar photovoltaic panels — Not applicable
V2 Wind turbine — Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: D 67
Potential environmental impact rating: A 93

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£796	£796	£0
Space heating	£291	£291	£0
Water heating	£481	£481	£0
Lighting	£24	£24	£0
Generated (PV)	-£74	-£74	£0
Total cost of fuels	£722	£722	£0
Total cost of uses	£722	£722	£0
Delivered energy	77 kWh/m²	77 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	11 kg/m²	11 kg/m²	0 kg/m²
Primary energy	123 kWh/m²	123 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	35.9300	(1b)	x 4.7500	(2b) =	170.6675	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	35.9300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		170.6675	(5)

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2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			5.6900	1.2357	7.0314			(27)
Heatloss Floor 1			35.9300	0.1200	4.3116	75.0000	2694.7500	(28a)
External Wall 1	29.4800	5.6900	23.7900	0.1400	3.3306	14.0000	333.0600	(29a)
Wall to Unheated Bike Store	34.2500		34.2500	0.1400	4.7950	14.0000	479.5000	(29a)
Total net area of external elements Aum(A, m2)			99.6600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	19.4686			(33)
Party Wall 1			34.2200	0.0000	0.0000	20.0000	684.4000	(32)
Wall to corridor			27.4200	0.0000	0.0000	20.0000	548.4000	(32)
Party Ceiling 1			35.9300			80.0000	2874.4000	(32b)
Internal Wall 1			103.4900			9.0000	931.4100	(32c)
Internal Floor 1			21.1000			0.0000	0.0000	(32d)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 8545.9200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 237.8492 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.4400	0.0500	0.1220
E3 Sill	2.4400	0.0500	0.1220
E4 Jamb	9.3000	0.0500	0.4650
E5 Ground floor (normal)	12.3700	0.1600	1.9792
E18 Party wall between dwellings	5.1500	0.0600	0.3090
P1 Party wall - Ground floor	11.9700	0.0800	0.9576
P2 Party wall - Intermediate floor within a dwelling	9.2800	0.0000	0.0000
E6 Intermediate floor within a dwelling	6.5000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.9548 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 23.4234 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.2326	16.0689	15.9052	15.0868	14.9231	14.1047	14.1047	13.9410	14.4321	14.9231	15.2505	15.5778	(38)
Heat transfer coeff	39.6559	39.4922	39.3286	38.5102	38.3465	37.5281	37.5281	37.3644	37.8554	38.3465	38.6738	39.0012	(39)

Average = Sum(39)m / 12 = 38.4692

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1037	1.0991	1.0946	1.0718	1.0673	1.0445	1.0445	1.0399	1.0536	1.0673	1.0764	1.0855	(40)
HLP (average)												1.0707	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.3029 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	81.2374	80.0165	78.2375	74.8337	72.3218	69.5205	67.9283	69.6938	71.6292	74.6369	78.1138	80.9261	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	27.9726	26.9554	25.9383	24.9211	23.9039	22.8867	22.8867	23.9039	24.9211	25.9383	26.9554	27.9726	(42c)

Average daily hot water use (litres/day) 100.3278 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.2100	106.9720	104.1758	99.7548	96.2257	92.4072	90.8150	93.5977	96.5503	100.5752	105.0693	108.8987	(44)
Energy conte	172.9619	152.3267	160.1143	136.5593	129.5383	113.6255	109.8329	115.8935	119.0561	136.4795	149.6904	170.5091	(45)

Energy content (annual) Total = Sum(45)m = 1666.5875

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Distribution loss (46)m = 0.15 x (45)m	25.9443	22.8490	24.0171	20.4839	19.4307	17.0438	16.4749	17.3840	17.8584	20.4719	22.4536	25.5764	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(64)

Total per year (kWh/year) = Sum(64)m = 1913.6195 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat gains from water heating, kWh/month	74.2945	65.8089	70.0226	61.6492	59.8561	54.0237	53.3041	55.3192	55.8294	62.1641	66.0153	73.4789	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.2890	11.8032	9.5990	7.2670	5.4322	4.5861	4.9554	6.4413	8.6455	10.9774	12.8122	13.6583	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	166.3438	168.0699	163.7201	154.4599	142.7706	131.7843	124.4448	122.7187	127.0684	136.3286	148.0179	159.0042	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	(71)
Water heating gains (Table 5)													
	99.8582	97.9300	94.1165	85.6239	80.4518	75.0329	71.6452	74.3538	77.5408	83.5539	91.6879	98.7620	(72)
Total internal gains													
	349.6683	347.9804	337.6129	317.5282	298.8319	281.5806	271.2228	273.6911	283.4320	301.0372	322.6954	341.6019	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.6900	11.2829	0.6300	0.8270	0.7700	23.1800	(75)

Solar gains	23.1800	47.1836	85.0099	139.6106	187.6641	200.0697	187.1611	149.2070	103.5858	57.6621	29.1665	18.9300	(83)
Total gains	372.8483	395.1640	422.6227	457.1388	486.4960	481.6503	458.3839	422.8981	387.0178	358.6993	351.8618	360.5319	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8616	60.1097	60.3599	61.6426	61.9057	63.2557	63.2557	63.5329	62.7087	61.9057	61.3817	60.8665	
alpha	4.9908	5.0073	5.0240	5.1095	5.1270	5.2170	5.2170	5.2355	5.1806	5.1270	5.0921	5.0578	
util living area													
	0.9743	0.9629	0.9312	0.8442	0.6862	0.4919	0.3591	0.4043	0.6435	0.8777	0.9568	0.9775	(86)
MIT	20.0642	20.2001	20.4459	20.7479	20.9282	20.9898	20.9984	20.9971	20.9616	20.7353	20.3679	20.0489	(87)
Th 2	19.9978	20.0015	20.0053	20.0239	20.0277	20.0464	20.0464	20.0502	20.0389	20.0277	20.0202	20.0127	(88)
util rest of house													
	0.9674	0.9531	0.9133	0.8080	0.6282	0.4216	0.2819	0.3219	0.5658	0.8400	0.9438	0.9714	(89)
MIT 2	18.9462	19.1180	19.4212	19.7854	19.9722	20.0409	20.0459	20.0492	20.0152	19.7842	19.3435	18.9386	(90)
Living area fraction										fLA = Living area / (4) =		0.7762	(91)
MIT	19.8140	19.9580	20.2166	20.5325	20.7143	20.7774	20.7852	20.7850	20.7498	20.5225	20.1386	19.8004	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8140	19.9580	20.2166	20.5325	20.7143	20.7774	20.7852	20.7850	20.7498	20.5225	20.1386	19.8004	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9659	0.9526	0.9175	0.8277	0.6698	0.4758	0.3418	0.3858	0.6241	0.8604	0.9456	0.9699	(94)
Useful gains	360.1523	376.4296	387.7545	378.3888	325.8786	229.1488	156.6771	163.1395	241.5390	308.6366	332.7047	349.6635	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	615.2221	594.6729	539.4548	447.9705	345.6668	231.8276	157.0641	163.8421	251.7323	380.4928	504.2540	608.4346	(97)
Space heating kWh													
	189.7719	146.6595	112.8650	50.0989	14.7224	0.0000	0.0000	0.0000	0.0000	53.4610	123.5155	192.5257	(98a)
Space heating requirement - total per year (kWh/year)												883.6199	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	189.7719	146.6595	112.8650	50.0989	14.7224	0.0000	0.0000	0.0000	0.0000	53.4610	123.5155	192.5257	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												883.6199	
Space heating per m2											(98c) / (4) =	24.5928	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	189.7719	146.6595	112.8650	50.0989	14.7224	0.0000	0.0000	0.0000	0.0000	53.4610	123.5155	192.5257	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	189.7719	146.6595	112.8650	50.0989	14.7224	0.0000	0.0000	0.0000	0.0000	53.4610	123.5155	192.5257	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.1215	11.8517	13.1215	12.6982	13.1215	12.6982	13.1215	13.1215	12.6982	13.1215	12.6982	13.1215	(231)
Lighting	11.6318	9.3314	8.4019	6.1556	4.7548	3.8847	4.3375	5.6380	7.3232	9.6084	10.8527	11.9551	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-8.8687	-14.3525	-23.6272	-29.8127	-34.7626	-33.2468	-32.7381	-29.3867	-23.7830	-17.4874	-10.2856	-7.4485	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													

(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.2701	-3.0283	-7.0021	-12.4021	-18.1612	-19.0419	-18.7557	-15.1361	-10.3078	-5.0306	-1.8364	-0.9686	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	883.6199	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	1913.6195	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	154.4950	(230a)
Total electricity for the above, kWh/year	154.4950	(231)
Electricity for lighting (calculated in Appendix L)	93.8751	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-378.7407	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2666.8689	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	883.6199	16.4900	145.7089	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1913.6195	16.4900	315.5559	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	154.4950	16.4900	25.4762	(249)
Energy for lighting	93.8751	16.4900	15.4800	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-265.7998	16.4900	-43.8304	
PV Unit electricity exported	-112.9409	5.5900	-6.3134	
Total			-50.1438	(252)
Total energy cost			452.0773	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	2.0110	(257)
SAP value	67.4022	
SAP rating (Section 12)	67	(258)
SAP band	D	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	883.6199	0.1563	138.0774	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1913.6195	0.1412	270.2448	(264)
Space and water heating			408.3223	(265)
Pumps, fans and electric keep-hot	154.4950	0.1387	21.4304	(267)
Energy for lighting	93.8751	0.1443	13.5491	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-265.7998	0.1323	-35.1707	
PV Unit electricity exported	-112.9409	0.1219	-13.7709	
Total			-48.9416	(269)
Total CO2, kg/year			394.3601	(272)
CO2 emissions per m2			10.9800	(273)
EI value			93.4704	
EI rating			93	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

Area	Storey height	Volume

	(m2)		(m)		(m3)	
Ground floor	35.9300 (1b)	x	4.7500 (2b)	=	170.6675	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	35.9300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.6675	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			5.6900	1.2357	7.0314			(27)
Heatloss Floor 1			35.9300	0.1200	4.3116	75.0000	2694.7500	(28a)
External Wall 1	29.4800	5.6900	23.7900	0.1400	3.3306	14.0000	333.0600	(29a)
Wall to Unheated Bike Store	34.2500		34.2500	0.1400	4.7950	14.0000	479.5000	(29a)
Total net area of external elements Aum(A, m2)			99.6600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		19.4686			(33)
Party Wall 1			34.2200	0.0000	0.0000	20.0000	684.4000	(32)
Wall to corridor			27.4200	0.0000	0.0000	20.0000	548.4000	(32)
Party Ceiling 1			35.9300			80.0000	2874.4000	(32b)
Internal Wall 1			103.4900			9.0000	931.4100	(32c)
Internal Floor 1			21.1000			0.0000	0.0000	(32d)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	8545.9200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		237.8492 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.4400	0.0500	0.1220
E3 Sill	2.4400	0.0500	0.1220
E4 Jamb	9.3000	0.0500	0.4650
E5 Ground floor (normal)	12.3700	0.1600	1.9792
E18 Party wall between dwellings	5.1500	0.0600	0.3090
P1 Party wall - Ground floor	11.9700	0.0800	0.9576
P2 Party wall - Intermediate floor within a dwelling	9.2800	0.0000	0.0000
E6 Intermediate floor within a dwelling	6.6500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.9548 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	23.4234 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3962	16.3962	16.0689	15.0868	14.9231	14.2684	13.9410	13.9410	14.5958	15.4142	15.7415	15.5778	(38)
Heat transfer coeff	39.8196	39.8196	39.4922	38.5102	38.3465	37.6918	37.3644	37.3644	38.0191	38.8375	39.1649	39.0012	(39)
Average = Sum(39)m / 12 =												38.6193	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1083	1.1083	1.0991	1.0718	1.0673	1.0490	1.0399	1.0399	1.0581	1.0809	1.0900	1.0855	(40)
HLP (average)												1.0748	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.3029	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	81.2374	80.0165	78.2375	74.8337	72.3218	69.5205	67.9283	69.6938	71.6292	74.6369	78.1138	80.9261	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	27.9726	26.9554	25.9383	24.9211	23.9039	22.8867	22.8867	23.9039	24.9211	25.9383	26.9554	27.9726	(42c)
Average daily hot water use (litres/day)												100.3278	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

	109.2100	106.9720	104.1758	99.7548	96.2257	92.4072	90.8150	93.5977	96.5503	100.5752	105.0693	108.8987	(44)
Energy conte	172.9619	152.3267	160.1143	136.5593	129.5383	113.6255	109.8329	115.8935	119.0561	136.4795	149.6904	170.5091	(45)
Energy content (annual)											Total = Sum(45)m =	1666.5875	
Distribution loss (46)m = 0.15 x (45)m													
	25.9443	22.8490	24.0171	20.4839	19.4307	17.0438	16.4749	17.3840	17.8584	20.4719	22.4536	25.5764	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(64)
											Total per year (kWh/year) = Sum(64)m =	1913.6195	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Heat gains from water heating, kWh/month													
	74.2945	65.8089	70.0226	61.6492	59.8561	54.0237	53.3041	55.3192	55.8294	62.1641	66.0153	73.4789	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	78.1718	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.2890	11.8032	9.5990	7.2670	5.4322	4.5861	4.9554	6.4413	8.6455	10.9774	12.8122	13.6583	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	166.3438	168.0699	163.7201	154.4599	142.7706	131.7843	124.4448	122.7187	127.0684	136.3286	148.0179	159.0042	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	44.1200	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	-52.1145	(71)
Water heating gains (Table 5)													
	99.8582	97.9300	94.1165	85.6239	80.4518	75.0329	71.6452	74.3538	77.5408	83.5539	91.6879	98.7620	(72)
Total internal gains													
	349.6683	347.9804	337.6129	317.5282	298.8319	281.5806	271.2228	273.6911	283.4320	301.0372	322.6954	341.6019	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.6900	10.0309	0.6300	0.8270	0.7700	20.6078	(75)

Solar gains	20.6078	44.6153	83.8589	145.3011	194.3041	201.8896	190.9713	147.3724	101.3317	54.1341	26.6175	17.2319	(83)
Total gains	370.2761	392.5957	421.4717	462.8292	493.1360	483.4702	462.1941	421.0634	384.7637	355.1713	349.3129	358.8338	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.6155	59.6155	60.1097	61.6426	61.9057	62.9811	63.5329	63.5329	62.4388	61.1230	60.6121	60.8665	
alpha	4.9744	4.9744	5.0073	5.1095	5.1270	5.1987	5.2355	5.2355	5.1626	5.0749	5.0408	5.0578	
util living area													
	0.9774	0.9689	0.9450	0.8701	0.7322	0.5893	0.4869	0.5391	0.7388	0.9099	0.9640	0.9804	(86)
MIT	20.0023	20.1099	20.3424	20.6795	20.8932	20.9712	20.9909	20.9852	20.9132	20.6363	20.2868	19.9856	(87)
Th 2	19.9941	19.9941	20.0015	20.0239	20.0277	20.0427	20.0502	20.0502	20.0352	20.0164	20.0090	20.0127	(88)
util rest of house													
	0.9713	0.9607	0.9308	0.8400	0.6807	0.5238	0.4139	0.4613	0.6737	0.8814	0.9531	0.9752	(89)
MIT 2	18.8656	18.9999	19.2923	19.7081	19.9386	20.0237	20.0455	20.0423	19.9708	19.6629	19.2349	18.8588	(90)
Living area fraction										fLA = Living area / (4) =		0.7762	(91)
MIT	19.7479	19.8615	20.1074	20.4622	20.6796	20.7592	20.7793	20.7742	20.7024	20.4185	20.0514	19.7335	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7479	19.8615	20.1074	20.4622	20.6796	20.7592	20.7793	20.7742	20.7024	20.4185	20.0514	19.7335	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9696	0.9595	0.9325	0.8543	0.7160	0.5732	0.4702	0.5210	0.7198	0.8940	0.9537	0.9734	(94)
Useful gains	359.0224	376.6959	393.0222	395.3719	353.0609	277.1382	217.3077	219.3664	276.9708	317.5265	333.1270	349.2892	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	631.0589	619.6534	572.9308	483.7706	382.6815	284.9193	219.6772	223.2224	300.4407	416.2797	526.8241	625.3249	(97)
Space heating kWh													
	202.3952	163.2674	133.8520	63.6471	22.0377	0.0000	0.0000	0.0000	0.0000	73.4723	139.4619	205.3705	(98a)
Space heating requirement - total per year (kWh/year)												1003.5041	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	202.3952	163.2674	133.8520	63.6471	22.0377	0.0000	0.0000	0.0000	0.0000	73.4723	139.4619	205.3705	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 1003.5041
Space heating per m2 (98c) / (4) = 27.9294 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 100.0000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	202.3952	163.2674	133.8520	63.6471	22.0377	0.0000	0.0000	0.0000	0.0000	73.4723	139.4619	205.3705	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	202.3952	163.2674	133.8520	63.6471	22.0377	0.0000	0.0000	0.0000	0.0000	73.4723	139.4619	205.3705	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	193.9427	171.2771	181.0951	156.8633	150.5191	133.9295	130.8137	136.8743	139.3601	157.4603	169.9944	191.4899	(219)
Space cooling fuel requirement												0.0000	(221)
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
Pumps and Fa	13.1215	11.8517	13.1215	12.6982	13.1215	12.6982	13.1215	13.1215	12.6982	13.1215	12.6982	13.1215	(231)
Lighting	11.6318	9.3314	8.4019	6.1556	4.7548	3.8847	4.3375	5.6380	7.3232	9.6084	10.8527	11.9551	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-8.0185	-13.8258	-23.7611	-31.3571	-36.2395	-33.7534	-33.5336	-29.3960	-23.6207	-16.8408	-9.5629	-6.8751	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.0684	-2.7891	-6.8577	-13.1670	-19.2047	-19.5759	-19.5982	-15.1448	-10.1853	-4.5556	-1.5993	-0.8422	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year
Space heating fuel - main system 1 1003.5041 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 100.0000
Water heating fuel used 1913.6195 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)
mechanical ventilation fans (SFP = 0.7420) 154.4950 (230a)
Total electricity for the above, kWh/year 154.4950 (231)
Electricity for lighting (calculated in Appendix L) 93.8751 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation -381.3727 (233)
Wind generation 0.0000 (234)
Hydro-electric generation (Appendix N) 0.0000 (235a)
Electricity generated - Micro CHP (Appendix N) 0.0000 (235)
Appendix Q - special features
Energy saved or generated -0.0000 (236)
Energy used 0.0000 (237)
Total delivered energy for all uses 2784.1212 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1003.5041	25.1600	252.4816	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1913.6195	25.1600	481.4667	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	154.4950	25.1600	38.8710	(249)
Energy for lighting	93.8751	25.1600	23.6190	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-266.7845	25.1600	-67.1230	
PV Unit electricity exported	-114.5882	5.8100	-6.6576	
Total			-73.7805	(252)
Total energy cost			722.6577	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1003.5041	0.1556	156.1294	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1913.6195	0.1412	270.2448	(264)
Space and water heating			426.3743	(265)

Pumps, fans and electric keep-hot	154.4950	0.1387	21.4304	(267)
Energy for lighting	93.8751	0.1443	13.5491	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-266.7845	0.1320	-35.2240	
PV Unit electricity exported	-114.5882	0.1213	-13.9032	
Total			-49.1272	(269)
Total CO2, kg/year			412.2266	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1003.5041	1.5760	1581.5504	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1913.6195	1.5222	2912.9178	(278)
Space and water heating			4494.4683	(279)
Pumps, fans and electric keep-hot	154.4950	1.5128	233.7201	(281)
Energy for lighting	93.8751	1.5338	143.9888	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-266.7845	1.4878	-396.9312	
PV Unit electricity exported	-114.5882	0.4452	-51.0109	
Total			-447.9421	(283)
Total Primary energy kWh/year			4424.2351	(286)

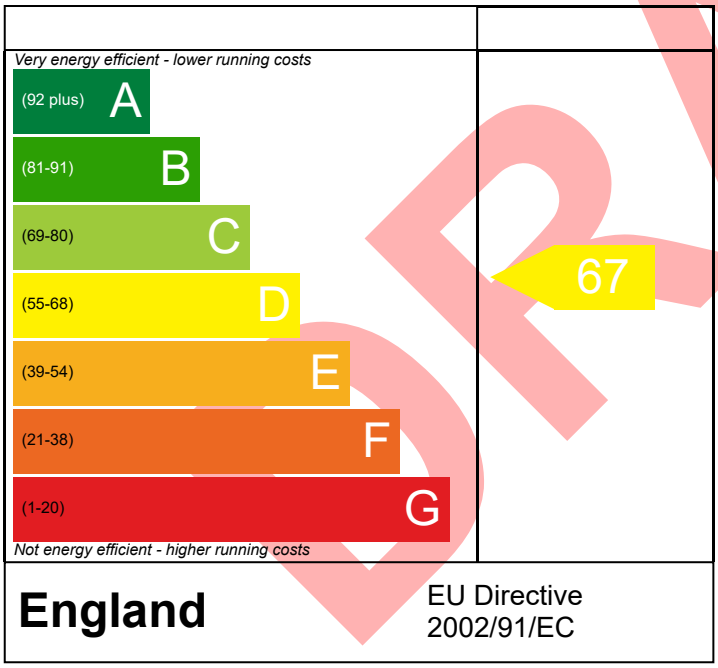
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	35.93 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

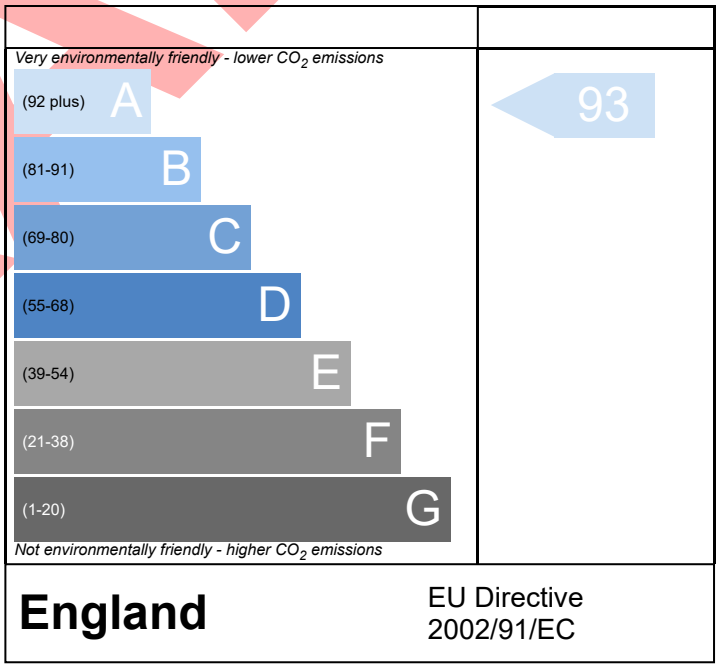
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:50

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	51 m^2
Site Reference	Unit 286 L01 _Copy	Plot Reference	Unit 286 L01_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*13.31 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	5.76 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*72.23 kWh$_{PE}$/m^2*	
Dwelling primary energy	65.31 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*23.7 kWh/m^2*	
Dwelling fabric energy efficiency	21.6 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.12	Heatloss Floor 1 (0.12)	OK
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	7.91	0.14 **(!)**
Party wall: Party Wall (1)	47.52	0 **(!)**
Party wall: Party Wall (2)	15.79	0 **(!)**
Upper floor: Heatloss Floor 1, Heatloss Floor 1	51.48	0.12

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SE, Opening Type 1	7.88	South East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E20: Exposed floor (normal)	Calculated by person with suitable expertise	0.32	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P7: Exposed floor (normal)	Calculated by person with suitable expertise	0.16	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.87 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 286 L01 _Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 286 L01_Copy	**Prop Type Ref**	Unit 286 L01
Property			

SAP Rating	79 C	**DER**	5.76	**TER**	13.31
Environmental	96 A	**% DER < TER**			56.72
CO_2 Emissions (t/year)	0.3	**DFEE**	21.63	**TFEE**	23.75
Compliance Check	See BREL	**% DFEE < TFEE**			8.92
% DPER < TPER	9.57	**DPER**	65.31	**TPER**	72.23

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.4800 (1b)	x	2.4000 (2b)	=	123.5520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.4800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	123.5520	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
Heatloss Floor 1			51.4800	0.1200	6.1776	75.0000	3861.0000	(28b)
External Wall 1	15.7900	7.8800	7.9100	0.1400	1.1074	14.0000	110.7400	(29a)
Total net area of external elements Aum(A, m2)			67.2700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		17.0226			(33)
Party Wall 1			47.5200	0.0000	0.0000	20.0000	950.4000	(32)
Wall to corridor			15.7900	0.0000	0.0000	20.0000	315.8000	(32)
Party Ceiling 1			51.4800			80.0000	4118.4000	(32b)
Internal Wall 1			80.1900			9.0000	721.7100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10078.0500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		195.7663 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695

E4 Jamb	9.2800	0.0500	0.4640	
E20 Exposed floor (normal)	5.8500	0.3200	1.8720	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P7 Party Wall - Exposed floor (normal)	23.4500	0.1600	3.7520	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				6.5815 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	23.6041 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.7513	11.6328	11.5143	10.9218	10.8033	10.2109	10.2109	10.0924	10.4479	10.8033	11.0403	11.2773	(38)
Heat transfer coeff	35.3554	35.2369	35.1185	34.5260	34.4075	33.8150	33.8150	33.6965	34.0520	34.4075	34.6445	34.8815	(39)
Average = Sum(39)m / 12 =												34.4964	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6868	0.6845	0.6822	0.6707	0.6684	0.6569	0.6569	0.6546	0.6615	0.6684	0.6730	0.6776	(40)
HLP (average)												0.6701	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.7337	(42)
Hot water usage for mixer showers	73.2716	72.1705	70.5659	67.4959	65.2303	62.7037	61.2676	62.8600	64.6056	67.3184	70.4543	72.9909	(42a)
Hot water usage for baths	23.0390	22.6968	22.2150	21.3266	20.6614	19.9237	19.5253	20.0037	20.5247	21.3140	22.2207	22.9611	(42b)
Hot water usage for other uses	32.3851	31.2075	30.0298	28.8522	27.6746	26.4969	26.4969	27.6746	28.8522	30.0298	31.2075	32.3851	(42c)
Average daily hot water use (litres/day)												118.3558	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.6957	126.0748	122.8108	117.6747	113.5662	109.1243	107.2898	110.5383	113.9825	118.6622	123.8825	128.3371	(44)
Energy conte	203.8226	179.5288	188.7556	161.0907	152.8819	134.1811	129.7577	136.8695	140.5518	161.0235	176.4934	200.9449	(45)
Energy content (annual)										Total = Sum(45)m =		1965.9015	
Distribution loss (46)m = 0.15 x (45)m	30.5734	26.9293	28.3133	24.1636	22.9323	20.1272	19.4636	20.5304	21.0828	24.1535	26.4740	30.1417	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
										Total per year (kWh/year) = Sum(64)m =		2212.9335	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	84.5557	74.8537	79.5459	69.8059	67.6179	60.8584	59.9291	62.2937	62.9767	70.3250	74.9273	83.5988	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.7487	15.7643	12.8204	9.7058	7.2552	6.1252	6.6185	8.6029	11.5468	14.6613	17.1120	18.2420	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	225.4877	227.8276	221.9312	209.3786	193.5331	178.6406	168.6914	166.3516	172.2479	184.8006	200.6461	215.5386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	(71)
Water heating gains (Table 5)	113.6501	111.3894	106.9165	96.9526	90.8842	84.5256	80.5498	83.7281	87.4676	94.5228	104.0656	112.3640	(72)
Total internal gains	438.6972	436.7919	423.4788	397.8477	373.4832	351.1020	337.6704	340.4934	353.0731	375.7954	403.6344	427.9553	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(77)

Solar gains	104.6841	178.3157	243.9793	302.3022	338.6036	336.1550	324.0893	297.0068	264.1780	197.0768	125.3874	89.5877	(83)
Total gains	543.3813	615.1076	667.4580	700.1498	712.0869	687.2570	661.7597	637.5001	617.2510	572.8722	529.0217	517.5431	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000	(85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	79.1804	79.4467	79.7147	81.0826	81.3619	82.7874	82.7874	83.0785	82.2113	81.3619	80.8053	80.2563	
alpha	6.2787	6.2964	6.3143	6.4055	6.4241	6.5192	6.5192	6.5386	6.4808	6.4241	6.3870	6.3504	
util living area	0.8957	0.8257	0.7249	0.5877	0.4479	0.3148	0.2248	0.2431	0.3802	0.6129	0.8208	0.9114	(86)
MIT	20.7097	20.8336	20.9289	20.9823	20.9971	20.9998	21.0000	21.0000	20.9992	20.9811	20.8671	20.6793	(87)
Th 2	20.3525	20.3546	20.3566	20.3668	20.3689	20.3791	20.3791	20.3811	20.3750	20.3689	20.3648	20.3607	(88)
util rest of house	0.8806	0.8052	0.6993	0.5590	0.4180	0.2843	0.1931	0.2104	0.3459	0.5787	0.7969	0.8979	(89)
MIT 2	20.0329	20.1776	20.2851	20.3505	20.3665	20.3790	20.3791	20.3811	20.3745	20.3522	20.2279	20.0044	(90)
Living area fraction										fLA = Living area / (4) =		0.5577	(91)
MIT	20.4104	20.5435	20.6441	20.7028	20.7182	20.7252	20.7254	20.7263	20.7229	20.7029	20.5844	20.3808	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.4104	20.5435	20.6441	20.7028	20.7182	20.7252	20.7254	20.7263	20.7229	20.7029	20.5844	20.3808	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8821	0.8114	0.7109	0.5743	0.4346	0.3013	0.2108	0.2287	0.3650	0.5969	0.8054	0.8984	(94)
Useful gains	479.2980	499.1085	474.4886	402.0899	309.4486	207.0650	139.4947	145.7724	225.3128	341.9574	426.0788	464.9528	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	569.5891	551.2276	496.7204	407.5046	310.2931	207.1232	139.4990	145.7797	225.5227	347.6163	467.1589	564.4104	(97)
Space heating kWh	67.1766	35.0240	16.5405	3.8986	0.6283	0.0000	0.0000	0.0000	0.0000	4.2102	29.5777	73.9965	(98a)
Space heating requirement - total per year (kWh/year)												231.0524	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	67.1766	35.0240	16.5405	3.8986	0.6283	0.0000	0.0000	0.0000	0.0000	4.2102	29.5777	73.9965	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												231.0524	
Space heating per m2											(98c) / (4) =	4.4882	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	67.1766	35.0240	16.5405	3.8986	0.6283	0.0000	0.0000	0.0000	0.0000	4.2102	29.5777	73.9965	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	67.1766	35.0240	16.5405	3.8986	0.6283	0.0000	0.0000	0.0000	0.0000	4.2102	29.5777	73.9965	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9614	8.0942	8.9614	8.6723	8.9614	8.6723	8.9614	8.9614	8.6723	8.9614	8.6723	8.9614	(231)
Lighting	15.5353	12.4630	11.2216	8.2214	6.3505	5.1884	5.7931	7.5301	9.7808	12.8330	14.4948	15.9671	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.7932	-24.8711	-40.0165	-49.8859	-58.2084	-55.8844	-54.9979	-49.8461	-40.9479	-30.1787	-18.1156	-13.3368	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.3823	-8.0014	-17.9129	-29.9551	-41.8867	-43.0093	-42.3927	-34.3601	-23.5283	-12.4097	-4.8106	-2.5824	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	231.0524	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2212.9335	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	105.5134	(230a)
Total electricity for the above, kWh/year	105.5134	(231)
Electricity for lighting (calculated in Appendix L)	125.3792	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-716.3140	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1958.5644	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	231.0524	16.4900	38.1005	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	16.4900	364.9127	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	105.5134	16.4900	17.3992	(249)
Energy for lighting	125.3792	16.4900	20.6750	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-452.0826	16.4900	-74.5484	
PV Unit electricity exported	-264.2313	5.5900	-14.7705	
Total			-89.3190	(252)
Total energy cost			351.7685	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.3126	(257)
SAP value		78.7233	
SAP rating (Section 12)		79	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	231.0524	0.1594	36.8250	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2212.9335	0.1413	312.5953	(264)
Space and water heating			349.4203	(265)
Pumps, fans and electric keep-hot	105.5134	0.1387	14.6360	(267)
Energy for lighting	125.3792	0.1443	18.0961	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-452.0826	0.1325	-59.8964	
PV Unit electricity exported	-264.2313	0.1233	-32.5814	
Total			-92.4778	(269)
Total CO2, kg/year			289.6746	(272)
CO2 emissions per m2			5.6300	(273)
EI value			95.9767	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		51.4800 (1b)	x	2.4000 (2b)	=	123.5520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.4800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	123.5520	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
Heatloss Floor 1			51.4800	0.1200	6.1776	75.0000	3861.0000	(28b)
External Wall 1	15.7900	7.8800	7.9100	0.1400	1.1074	14.0000	110.7400	(29a)
Total net area of external elements Aum(A, m2)			67.2700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	17.0226			(33)
Party Wall 1			47.5200	0.0000	0.0000	20.0000	950.4000	(32)
Wall to corridor			15.7900	0.0000	0.0000	20.0000	315.8000	(32)
Party Ceiling 1			51.4800			80.0000	4118.4000	(32b)
Internal Wall 1			80.1900			9.0000	721.7100	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 10078.0500 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 195.7663 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4 Jamb	9.2800	0.0500	0.4640
E20 Exposed floor (normal)	5.8500	0.3200	1.8720
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P7 Party Wall - Exposed floor (normal)	23.4500	0.1600	3.7520

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.5815 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 23.6041 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.8698	11.8698	11.6328	10.9218	10.8033	10.3294	10.0924	10.0924	10.5664	11.1588	11.3958	11.2773	(38)
Heat transfer coeff	35.4739	35.4739	35.2369	34.5260	34.4075	33.9335	33.6965	33.6965	34.1705	34.7630	35.0000	34.8815	(39)
Average = Sum(39)m / 12 =												34.6050	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6891	0.6891	0.6845	0.6707	0.6684	0.6592	0.6546	0.6546	0.6638	0.6753	0.6799	0.6776	(40)
HLP (average)												0.6722	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7337 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.2716	72.1705	70.5659	67.4959	65.2303	62.7037	61.2676	62.8600	64.6056	67.3184	70.4543	72.9909	(42a)
Hot water usage for baths	23.0390	22.6968	22.2150	21.3266	20.6614	19.9237	19.5253	20.0037	20.5247	21.3140	22.2207	22.9611	(42b)
Hot water usage for other uses	32.3851	31.2075	30.0298	28.8522	27.6746	26.4969	26.4969	27.6746	28.8522	30.0298	31.2075	32.3851	(42c)
Average daily hot water use (litres/day)												118.3558	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.6957	126.0748	122.8108	117.6747	113.5662	109.1243	107.2898	110.5383	113.9825	118.6622	123.8825	128.3371	(44)
Energy conte	203.8226	179.5288	188.7556	161.0907	152.8819	134.1811	129.7577	136.8695	140.5518	161.0235	176.4934	200.9449	(45)
Energy content (annual)										Total = Sum(45)m =		1965.9015	
Distribution loss (46)m = 0.15 x (45)m	30.5734	26.9293	28.3133	24.1636	22.9323	20.1272	19.4636	20.5304	21.0828	24.1535	26.4740	30.1417	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
									Total per year (kWh/year) = Sum(64)m =			2212.9335	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	84.5557	74.8537	79.5459	69.8059	67.6179	60.8584	59.9291	62.2937	62.9767	70.3250	74.9273	83.5988	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	17.7487	15.7643	12.8204	9.7058	7.2552	6.1252	6.6185	8.6029	11.5468	14.6613	17.1120	18.2420	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	225.4877	227.8276	221.9312	209.3786	193.5331	178.6406	168.6914	166.3516	172.2479	184.8006	200.6461	215.5386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	(71)
Water heating gains (Table 5)													
	113.6501	111.3894	106.9165	96.9526	90.8842	84.5256	80.5498	83.7281	87.4676	94.5228	104.0656	112.3640	(72)
Total internal gains													
	438.6972	436.7919	423.4788	397.8477	373.4832	351.1020	337.6704	340.4934	353.0731	375.7954	403.6344	427.9553	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(77)

Solar gains	95.2051	173.0844	247.4999	322.5774	357.6553	345.0938	336.8383	300.1802	265.5901	190.1488	117.1921	83.3220	(83)
Total gains	533.9023	609.8763	670.9786	720.4250	731.1385	696.1958	674.5087	640.6735	618.6632	565.9442	520.8265	511.2773	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.9159	78.9159	79.4467	81.0826	81.3619	82.4983	83.0785	83.0785	81.9262	80.5299	79.9846	80.2563	
alpha	6.2611	6.2611	6.2964	6.4055	6.4241	6.4999	6.5386	6.5386	6.4617	6.3687	6.3323	6.3504	
util living area													
	0.9108	0.8494	0.7571	0.6156	0.4823	0.3797	0.3046	0.3259	0.4514	0.6718	0.8490	0.9243	(86)
MIT	20.6635	20.7920	20.9030	20.9752	20.9951	20.9991	20.9998	20.9997	20.9974	20.9646	20.8268	20.6329	(87)
Th 2	20.3505	20.3505	20.3546	20.3668	20.3689	20.3770	20.3811	20.3811	20.3730	20.3627	20.3586	20.3607	(88)
util rest of house													
	0.8975	0.8309	0.7334	0.5884	0.4534	0.3496	0.2738	0.2935	0.4174	0.6390	0.8275	0.9126	(89)
MIT 2	19.9759	20.1258	20.2546	20.3432	20.3647	20.3764	20.3810	20.3810	20.3710	20.3302	20.1768	19.9484	(90)
Living area fraction									fLA = Living area / (4) =			0.5577	(91)
MIT	20.3594	20.4974	20.6163	20.6957	20.7163	20.7237	20.7261	20.7261	20.7203	20.6840	20.5393	20.3302	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3594	20.4974	20.6163	20.6957	20.7163	20.7237	20.7261	20.7261	20.7203	20.6840	20.5393	20.3302	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8977	0.8353	0.7432	0.6026	0.4694	0.3664	0.2910	0.3116	0.4363	0.6557	0.8338	0.9120	(94)
Useful gains	479.2838	509.4231	498.6699	434.1273	343.1762	255.0676	196.2770	199.6204	269.9122	371.1123	434.2794	466.2949	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	583.8785	574.5846	529.1269	441.7841	344.6342	255.3059	196.3206	199.6877	270.6422	381.8371	487.8746	580.0853	(97)
Space heating kWh													
	77.8185	43.7885	22.6600	5.5129	1.0848	0.0000	0.0000	0.0000	0.0000	7.9793	38.5886	84.6601	(98a)
Space heating requirement - total per year (kWh/year)												282.0925	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	77.8185	43.7885	22.6600	5.5129	1.0848	0.0000	0.0000	0.0000	0.0000	7.9793	38.5886	84.6601	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												282.0925	
Space heating per m2										(98c) / (4) =		5.4797	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	77.8185	43.7885	22.6600	5.5129	1.0848	0.0000	0.0000	0.0000	0.0000	7.9793	38.5886	84.6601	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	77.8185	43.7885	22.6600	5.5129	1.0848	0.0000	0.0000	0.0000	0.0000	7.9793	38.5886	84.6601	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9614	8.0942	8.9614	8.6723	8.9614	8.6723	8.9614	8.9614	8.6723	8.9614	8.6723	8.9614	(231)

Lighting	15.5353	12.4630	11.2216	8.2214	6.3505	5.1884	5.7931	7.5301	9.7808	12.8330	14.4948	15.9671 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-14.3332	-23.9948	-40.1126	-51.9926	-60.2125	-56.6684	-56.2267	-49.8608	-40.6847	-28.9825	-16.8865	-12.3449 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.8530	-7.4289	-17.7969	-32.2159	-44.6492	-44.1937	-44.2618	-34.3793	-23.2527	-11.4844	-4.2247	-2.2509 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	282.0925 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2212.9335 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	105.5134 (230a)
Total electricity for the above, kWh/year	105.5134 (231)
Electricity for lighting (calculated in Appendix L)	125.3792 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-721.2918 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2004.6268 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	282.0925	25.1600	70.9745	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	25.1600	556.7741	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	105.5134	25.1600	26.5472	(249)
Energy for lighting	125.3792	25.1600	31.5454	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-452.3003	25.1600	-113.7987	
PV Unit electricity exported	-268.9915	5.8100	-15.6284	
Total			-129.4272	(252)
Total energy cost			556.4140	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	282.0925	0.1588	44.8007	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2212.9335	0.1413	312.5953	(264)
Space and water heating			357.3961	(265)
Pumps, fans and electric keep-hot	105.5134	0.1387	14.6360	(267)
Energy for lighting	125.3792	0.1443	18.0961	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-452.3003	0.1322	-59.7887	
PV Unit electricity exported	-268.9915	0.1228	-33.0279	
Total			-92.8166	(269)
Total CO2, kg/year			297.3116	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	282.0925	1.5878	447.9155	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	1.5223	3368.8373	(278)
Space and water heating			3816.7528	(279)
Pumps, fans and electric keep-hot	105.5134	1.5128	159.6207	(281)
Energy for lighting	125.3792	1.5338	192.3107	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-452.3003	1.4884	-673.2111	
PV Unit electricity exported	-268.9915	0.4506	-121.2118	
Total			-794.4229	(283)
Total Primary energy kWh/year			3374.2613	(286)

SAP 10 EPC IMPROVEMENTS

Unit 286 L01_Copy

Current energy efficiency rating: C 79
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 79
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£686	£686	£0
Space heating	£98	£98	£0
Water heating	£557	£557	£0
Lighting	£32	£32	£0
Generated (PV)	-£129	-£129	£0
Total cost of fuels	£557	£557	£0
Total cost of uses	£558	£558	£0
Delivered energy	39 kWh/m²	39 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	66 kWh/m²	66 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.4800 (1b)	x	2.4000 (2b)	=	123.5520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.4800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	123.5520	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
Heatloss Floor 1			51.4800	0.1200	6.1776	75.0000	3861.0000	(28b)
External Wall 1	15.7900	7.8800	7.9100	0.1400	1.1074	14.0000	110.7400	(29a)
Total net area of external elements Aum(A, m2)			67.2700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		17.0226			(33)
Party Wall 1			47.5200	0.0000	0.0000	20.0000	950.4000	(32)
Wall to corridor			15.7900	0.0000	0.0000	20.0000	315.8000	(32)
Party Ceiling 1			51.4800			80.0000	4118.4000	(32b)
Internal Wall 1			80.1900			9.0000	721.7100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10078.0500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		195.7663 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	3.3900	0.0500	0.1695
E2 Other lintels (including other steel lintels)	9.2800	0.0500	0.4640
E4 Jamb	5.8500	0.3200	1.8720
E20 Exposed floor (normal)	5.4000	0.0600	0.3240
E18 Party wall between dwellings	23.4500	0.1600	3.7520

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.5815 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	23.6041 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.7513	11.6328	11.5143	10.9218	10.8033	10.2109	10.2109	10.0924	10.4479	10.8033	11.0403	11.2773	(38)
Heat transfer coeff	35.3554	35.2369	35.1185	34.5260	34.4075	33.8150	33.8150	33.6965	34.0520	34.4075	34.6445	34.8815	(39)
Average = Sum(39)m / 12 =												34.4964	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6868	0.6845	0.6822	0.6707	0.6684	0.6569	0.6569	0.6546	0.6615	0.6684	0.6730	0.6776	(40)
HLP (average)												0.6701	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.7337 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.2716	72.1705	70.5659	67.4959	65.2303	62.7037	61.2676	62.8600	64.6056	67.3184	70.4543	72.9909	(42a)

Hot water usage for baths

23.0390	22.6968	22.2150	21.3266	20.6614	19.9237	19.5253	20.0037	20.5247	21.3140	22.2207	22.9611	(42b)

Hot water usage for other uses

32.3851	31.2075	30.0298	28.8522	27.6746	26.4969	26.4969	27.6746	28.8522	30.0298	31.2075	32.3851	(42c)

Average daily hot water use (litres/day)		118.3558 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.6957	126.0748	122.8108	117.6747	113.5662	109.1243	107.2898	110.5383	113.9825	118.6622	123.8825	128.3371	(44)
Energy conte	203.8226	179.5288	188.7556	161.0907	152.8819	134.1811	129.7577	136.8695	140.5518	161.0235	176.4934	200.9449	(45)
Energy content (annual)										Total = Sum(45)m =		1965.9015	
Distribution loss (46)m = 0.15 x (45)m	30.5734	26.9293	28.3133	24.1636	22.9323	20.1272	19.4636	20.5304	21.0828	24.1535	26.4740	30.1417	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
								Total per year (kWh/year) = Sum(64)m =			2212.9335	(64)
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month													
84.5557	74.8537	79.5459	69.8059	67.6179	60.8584	59.9291	62.2937	62.9767	70.3250	74.9273	83.5988	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.7487	15.7643	12.8204	9.7058	7.2552	6.1252	6.6185	8.6029	11.5468	14.6613	17.1120	18.2420	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	225.4877	227.8276	221.9312	209.3786	193.5331	178.6406	168.6914	166.3516	172.2479	184.8006	200.6461	215.5386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	(71)
Water heating gains (Table 5)	113.6501	111.3894	106.9165	96.9526	90.8842	84.5256	80.5498	83.7281	87.4676	94.5228	104.0656	112.3640	(72)
Total internal gains	438.6972	436.7919	423.4788	397.8477	373.4832	351.1020	337.6704	340.4934	353.0731	375.7954	403.6344	427.9553	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(77)

Solar gains	104.6841	178.3157	243.9793	302.3022	338.6036	336.1550	324.0893	297.0068	264.1780	197.0768	125.3874	89.5877 (83)
Total gains	543.3813	615.1076	667.4580	700.1498	712.0869	687.2570	661.7597	637.5001	617.2510	572.8722	529.0217	517.5431 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	79.1804	79.4467	79.7147	81.0826	81.3619	82.7874	82.7874	83.0785	82.2113	81.3619	80.8053	80.2563	
alpha	6.2787	6.2964	6.3143	6.4055	6.4241	6.5192	6.5192	6.5386	6.4808	6.4241	6.3870	6.3504	
util living area	0.8957	0.8257	0.7249	0.5877	0.4479	0.3148	0.2248	0.2431	0.3802	0.6129	0.8208	0.9114	(86)
MIT	20.7097	20.8336	20.9289	20.9823	20.9971	20.9998	21.0000	21.0000	20.9992	20.9811	20.8671	20.6793	(87)
Th 2	20.3525	20.3546	20.3566	20.3668	20.3689	20.3791	20.3791	20.3811	20.3750	20.3689	20.3648	20.3607	(88)
util rest of house	0.8806	0.8052	0.6993	0.5590	0.4180	0.2843	0.1931	0.2104	0.3459	0.5787	0.7969	0.8979	(89)
MIT 2	20.0329	20.1776	20.2851	20.3505	20.3665	20.3790	20.3791	20.3811	20.3745	20.3522	20.2279	20.0044	(90)
Living area fraction									fLA = Living area / (4) =			0.5577	(91)
MIT	20.4104	20.5435	20.6441	20.7028	20.7182	20.7252	20.7254	20.7263	20.7229	20.7029	20.5844	20.3808	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.4104	20.5435	20.6441	20.7028	20.7182	20.7252	20.7254	20.7263	20.7229	20.7029	20.5844	20.3808	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8821	0.8114	0.7109	0.5743	0.4346	0.3013	0.2108	0.2287	0.3650	0.5969	0.8054	0.8984	(94)
Useful gains	479.2980	499.1085	474.4886	402.0899	309.4486	207.0650	139.4947	145.7724	225.3128	341.9574	426.0788	464.9528	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	569.5891	551.2276	496.7204	407.5046	310.2931	207.1232	139.4990	145.7797	225.5227	347.6163	467.1589	564.4104	(97)
Space heating kWh	67.1766	35.0240	16.5405	3.8986	0.6283	0.0000	0.0000	0.0000	0.0000	4.2102	29.5777	73.9965	(98a)
Space heating requirement - total per year (kWh/year)												231.0524	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	67.1766	35.0240	16.5405	3.8986	0.6283	0.0000	0.0000	0.0000	0.0000	4.2102	29.5777	73.9965	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												231.0524	
Space heating per m2											(98c) / (4) =	4.4882	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	67.1766	35.0240	16.5405	3.8986	0.6283	0.0000	0.0000	0.0000	0.0000	4.2102	29.5777	73.9965	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	67.1766	35.0240	16.5405	3.8986	0.6283	0.0000	0.0000	0.0000	0.0000	4.2102	29.5777	73.9965	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9614	8.0942	8.9614	8.6723	8.9614	8.6723	8.9614	8.9614	8.6723	8.9614	8.6723	8.9614	(231)
Lighting	15.5353	12.4630	11.2216	8.2214	6.3505	5.1884	5.7931	7.5301	9.7808	12.8330	14.4948	15.9671	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.7932	-24.8711	-40.0165	-49.8859	-58.2084	-55.8844	-54.9979	-49.8461	-40.9479	-30.1787	-18.1156	-13.3368	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.3823	-8.0014	-17.9129	-29.9551	-41.8867	-43.0093	-42.3927	-34.3601	-23.5283	-12.4097	-4.8106	-2.5824	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												231.0524	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2212.9335	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	105.5134	(230a)
Total electricity for the above, kWh/year	105.5134	(231)
Electricity for lighting (calculated in Appendix L)	125.3792	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-716.3140	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1958.5644	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	231.0524	16.4900	38.1005	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	16.4900	364.9127	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	105.5134	16.4900	17.3992	(249)
Energy for lighting	125.3792	16.4900	20.6750	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-452.0826	16.4900	-74.5484	
PV Unit electricity exported	-264.2313	5.5900	-14.7705	
Total			-89.3190	(252)
Total energy cost			351.7685	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.3126	(257)
SAP value		78.7233	
SAP rating (Section 12)		79	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	231.0524	0.1594	36.8250	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2212.9335	0.1413	312.5953	(264)
Space and water heating			349.4203	(265)
Pumps, fans and electric keep-hot	105.5134	0.1387	14.6360	(267)
Energy for lighting	125.3792	0.1443	18.0961	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-452.0826	0.1325	-59.8964	
PV Unit electricity exported	-264.2313	0.1233	-32.5814	
Total			-92.4778	(269)
Total CO2, kg/year			289.6746	(272)
CO2 emissions per m2			5.6300	(273)
EI value			95.9767	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		51.4800 (1b)	x	2.4000 (2b)	=	123.5520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.4800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	123.5520	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
Heatloss Floor 1			51.4800	0.1200	6.1776	75.0000	3861.0000	(28b)
External Wall 1	15.7900	7.8800	7.9100	0.1400	1.1074	14.0000	110.7400	(29a)
Total net area of external elements Aum(A, m2)			67.2700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		17.0226			(33)
Party Wall 1			47.5200	0.0000	0.0000	20.0000	950.4000	(32)
Wall to corridor			15.7900	0.0000	0.0000	20.0000	315.8000	(32)
Party Ceiling 1			51.4800			80.0000	4118.4000	(32b)
Internal Wall 1			80.1900			9.0000	721.7100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 10078.0500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	195.7663 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4 Jamb	9.2800	0.0500	0.4640
E20 Exposed floor (normal)	5.8500	0.3200	1.8720
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P7 Party Wall - Exposed floor (normal)	23.4500	0.1600	3.7520

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.5815 (36)
Point Thermal bridges	(36a) = 0.0000
Total fabric heat loss	(33) + (36) + (36a) = 23.6041 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.8698	11.8698	11.6328	10.9218	10.8033	10.3294	10.0924	10.0924	10.5664	11.1588	11.3958	11.2773	(38)
Heat transfer coeff	35.4739	35.4739	35.2369	34.5260	34.4075	33.9335	33.6965	33.6965	34.1705	34.7630	35.0000	34.8815	(39)
Average = Sum(39)m / 12 =												34.6050	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6891	0.6891	0.6845	0.6707	0.6684	0.6592	0.6546	0.6546	0.6638	0.6753	0.6799	0.6776	(40)
HLP (average)												0.6722	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7337 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.2716	72.1705	70.5659	67.4959	65.2303	62.7037	61.2676	62.8600	64.6056	67.3184	70.4543	72.9909	(42a)
Hot water usage for baths	23.0390	22.6968	22.2150	21.3266	20.6614	19.9237	19.5253	20.0037	20.5247	21.3140	22.2207	22.9611	(42b)
Hot water usage for other uses	32.3851	31.2075	30.0298	28.8522	27.6746	26.4969	26.4969	27.6746	28.8522	30.0298	31.2075	32.3851	(42c)
Average daily hot water use (litres/day)												118.3558	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.6957	126.0748	122.8108	117.6747	113.5662	109.1243	107.2898	110.5383	113.9825	118.6622	123.8825	128.3371	(44)
Energy conte	203.8226	179.5288	188.7556	161.0907	152.8819	134.1811	129.7577	136.8695	140.5518	161.0235	176.4934	200.9449	(45)
Energy content (annual)										Total = Sum(45)m =		1965.9015	
Distribution loss (46)m = 0.15 x (45)m	30.5734	26.9293	28.3133	24.1636	22.9323	20.1272	19.4636	20.5304	21.0828	24.1535	26.4740	30.1417	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
Total per year (kWh/year) = Sum(64)m =												2212.9335	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	84.5557	74.8537	79.5459	69.8059	67.6179	60.8584	59.9291	62.2937	62.9767	70.3250	74.9273	83.5988	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.7487	15.7643	12.8204	9.7058	7.2552	6.1252	6.6185	8.6029	11.5468	14.6613	17.1120	18.2420	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	225.4877	227.8276	221.9312	209.3786	193.5331	178.6406	168.6914	166.3516	172.2479	184.8006	200.6461	215.5386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	(71)
Water heating gains (Table 5)	113.6501	111.3894	106.9165	96.9526	90.8842	84.5256	80.5498	83.7281	87.4676	94.5228	104.0656	112.3640	(72)
Total internal gains	438.6972	436.7919	423.4788	397.8477	373.4832	351.1020	337.6704	340.4934	353.0731	375.7954	403.6344	427.9553	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(77)

Solar gains	95.2051	173.0844	247.4999	322.5774	357.6553	345.0938	336.8383	300.1802	265.5901	190.1488	117.1921	83.3220	(83)
Total gains	533.9023	609.8763	670.9786	720.4250	731.1385	696.1958	674.5087	640.6735	618.6632	565.9442	520.8265	511.2773	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.9159	78.9159	79.4467	81.0826	81.3619	82.4983	83.0785	83.0785	81.9262	80.5299	79.9846	80.2563	
alpha	6.2611	6.2611	6.2964	6.4055	6.4241	6.4999	6.5386	6.5386	6.4617	6.3687	6.3323	6.3504	
util living area	0.9108	0.8494	0.7571	0.6156	0.4823	0.3797	0.3046	0.3259	0.4514	0.6718	0.8490	0.9243	(86)
MIT	20.6635	20.7920	20.9030	20.9752	20.9951	20.9991	20.9998	20.9997	20.9974	20.9646	20.8268	20.6329	(87)
Th 2	20.3505	20.3505	20.3546	20.3668	20.3689	20.3770	20.3811	20.3811	20.3730	20.3627	20.3586	20.3607	(88)
util rest of house	0.8975	0.8309	0.7334	0.5884	0.4534	0.3496	0.2738	0.2935	0.4174	0.6390	0.8275	0.9126	(89)
MIT 2	19.9759	20.1258	20.2546	20.3432	20.3647	20.3764	20.3810	20.3810	20.3710	20.3302	20.1768	19.9484	(90)
Living area fraction									fLA = Living area / (4) =			0.5577	(91)
MIT	20.3594	20.4974	20.6163	20.6957	20.7163	20.7237	20.7261	20.7261	20.7203	20.6840	20.5393	20.3302	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3594	20.4974	20.6163	20.6957	20.7163	20.7237	20.7261	20.7261	20.7203	20.6840	20.5393	20.3302	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8977	0.8353	0.7432	0.6026	0.4694	0.3664	0.2910	0.3116	0.4363	0.6557	0.8338	0.9120	(94)
Useful gains	479.2838	509.4231	498.6699	434.1273	343.1762	255.0676	196.2770	199.6204	269.9122	371.1123	434.2794	466.2949	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	583.8785	574.5846	529.1269	441.7841	344.6342	255.3059	196.3206	199.6877	270.6422	381.8371	487.8746	580.0853	(97)
Space heating kWh	77.8185	43.7885	22.6600	5.5129	1.0848	0.0000	0.0000	0.0000	0.0000	7.9793	38.5886	84.6601	(98a)
Space heating requirement - total per year (kWh/year)												282.0925	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	77.8185	43.7885	22.6600	5.5129	1.0848	0.0000	0.0000	0.0000	0.0000	7.9793	38.5886	84.6601	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												282.0925	
Space heating per m2											(98c) / (4) =	5.4797	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	77.8185	43.7885	22.6600	5.5129	1.0848	0.0000	0.0000	0.0000	0.0000	7.9793	38.5886	84.6601	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													

	77.8185	43.7885	22.6600	5.5129	1.0848	0.0000	0.0000	0.0000	0.0000	7.9793	38.5886	84.6601 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating

Water heating requirement

	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	8.9614	8.0942	8.9614	8.6723	8.9614	8.6723	8.9614	8.9614	8.6723	8.9614	8.6723	8.9614 (231)
Lighting	15.5353	12.4630	11.2216	8.2214	6.3505	5.1884	5.7931	7.5301	9.7808	12.8330	14.4948	15.9671 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-14.3332	-23.9948	-40.1126	-51.9926	-60.2125	-56.6684	-56.2267	-49.8608	-40.6847	-28.9825	-16.8865	-12.3449 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.8530	-7.4289	-17.7969	-32.2159	-44.6492	-44.1937	-44.2618	-34.3793	-23.2527	-11.4844	-4.2247	-2.2509 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	282.0925 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2212.9335 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	105.5134 (230a)
Total electricity for the above, kWh/year	105.5134 (231)
Electricity for lighting (calculated in Appendix L)	125.3792 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-721.2918 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2004.6268 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	282.0925	25.1600	70.9745	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	25.1600	556.7741	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	105.5134	25.1600	26.5472	(249)
Energy for lighting	125.3792	25.1600	31.5454	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-452.3003	25.1600	-113.7987	
PV Unit electricity exported	-268.9915	5.8100	-15.6284	
Total			-129.4272	(252)
Total energy cost			556.4140	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	282.0925	0.1588	44.8007	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2212.9335	0.1413	312.5953	(264)
Space and water heating			357.3961	(265)
Pumps, fans and electric keep-hot	105.5134	0.1387	14.6360	(267)
Energy for lighting	125.3792	0.1443	18.0961	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-452.3003	0.1322	-59.7887	
PV Unit electricity exported	-268.9915	0.1228	-33.0279	
Total			-92.8166	(269)
Total CO2, kg/year			297.3116	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	282.0925	1.5878	447.9155	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	1.5223	3368.8373	(278)
Space and water heating			3816.7528	(279)

Pumps, fans and electric keep-hot	105.5134	1.5128	159.6207 (281)
Energy for lighting	125.3792	1.5338	192.3107 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-452.3003	1.4884	-673.2111
PV Unit electricity exported	-268.9915	0.4506	-121.2118
Total			-794.4229 (283)
Total Primary energy kWh/year			3374.2613 (286)

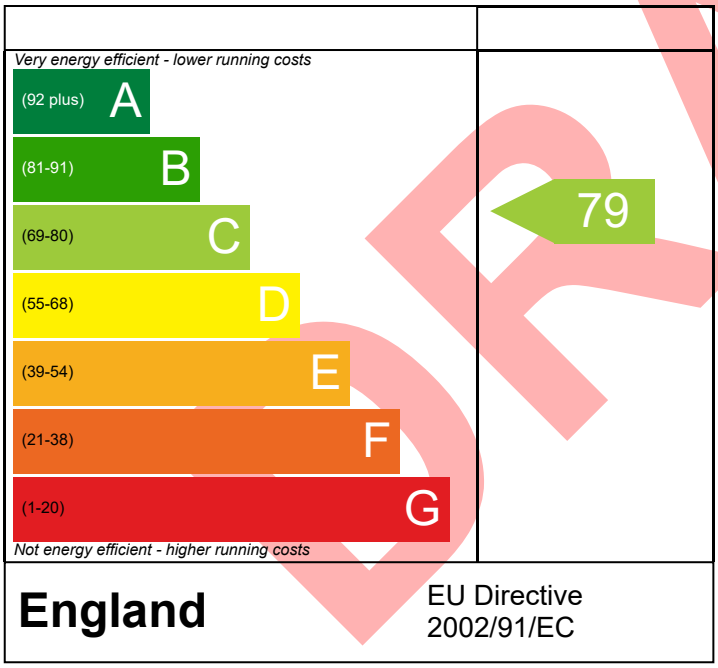
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	51.48 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

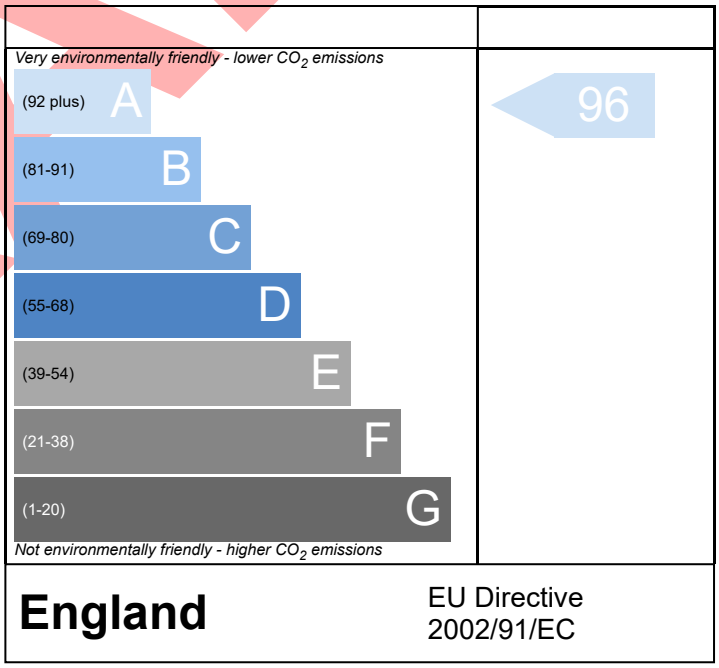
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:52

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	66 m^2
Site Reference	Unit 287 L01 _Copy	Plot Reference	Unit 287 L01_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*14.04 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	6.61 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*75.77 kWh_{PE}/m^2*	
Dwelling primary energy	72.37 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*34.3 kWh/m^2*	
Dwelling fabric energy efficiency	31.2 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.06	Floor to heated Ent (0.06)	OK
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	21.88	0.14 **(!)**
Party wall: Party Wall (1)	30.24	0 **(!)**
Party wall: Party Wall (2)	14.18	0 **(!)**
Ground floor: Floor to heated Ent, Floor to heated Ent	65.6	0.06 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	7.88	North East	0.83	1.3
N, Opening Type 1	3.59	North	0.83	1.3
NW, Opening Type 1	7.88	North West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.16	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.08	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.85 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 287 L01 _Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 287 L01_Copy	**Prop Type Ref**	Unit 287 L01
Property			

SAP Rating	74 C	**DER**	6.61	**TER**	14.04
Environmental	95 A	**% DER < TER**			52.92
CO_2 Emissions (t/year)	0.44	**DFEE**	31.18	**TFEE**	34.28
Compliance Check	See BREL	**% DFEE < TFEE**			9.03
% DPER < TPER	4.49	**DPER**	72.37	**TPER**	75.77

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.6000 (1b)	x	2.4000 (2b)	=	157.4400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	157.4400	(5)

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2. Ventilation rate

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	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.3500	1.2357	23.9116			(27)
Floor to heated Ent			65.6000	0.0600	3.9360	75.0000	4920.0000	(28a)
External Wall 1	41.2300	19.3500	21.8800	0.1400	3.0632	14.0000	306.3200	(29a)
Total net area of external elements Aum(A, m2)			106.8300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.9108			(33)
Party Wall 1			30.2400	0.0000	0.0000	20.0000	604.8000	(32)
Wall to corridor			14.1800	0.0000	0.0000	20.0000	283.6000	(32)
Party Ceiling 1			65.6000			80.0000	5248.0000	(32b)
Internal Wall 1			114.4800			9.0000	1030.3200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12393.0400	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	188.9183	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240

E4 Jamb	23.2000	0.0500	1.1600	
E5 Ground floor (normal)	15.2700	0.1600	2.4432	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P1 Party wall - Ground floor	16.4500	0.0800	1.3160	
E16 Corner (normal)	5.4000	0.0900	0.4860	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.1532 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 37.0640 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.7197	15.5541	15.3885	14.5604	14.3948	13.5668	13.5668	13.4012	13.8980	14.3948	14.7261	15.0573	(38)
Heat transfer coeff	52.7837	52.6181	52.4525	51.6244	51.4588	50.6308	50.6308	50.4652	50.9620	51.4588	51.7900	52.1213	(39)
Average = Sum(39)m / 12 =												51.5830	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8046	0.8021	0.7996	0.7870	0.7844	0.7718	0.7718	0.7693	0.7769	0.7844	0.7895	0.7945	(40)
HLP (average)												0.7863	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1348 (42)

Hot water usage for mixer showers

82.5173	81.2772	79.4702	76.0128	73.4613	70.6159	68.9985	70.7919	72.7577	75.8128	79.3445	82.2011	(42a)

Hot water usage for baths

25.9306	25.5455	25.0032	24.0033	23.2545	22.4243	21.9759	22.5144	23.1007	23.9891	25.0096	25.8429	(42b)

Hot water usage for other uses

36.4921	35.1651	33.8381	32.5112	31.1842	29.8572	29.8572	31.1842	32.5112	33.8381	35.1651	36.4921	(42c)

Average daily hot water use (litres/day) 133.2946 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.9400	141.9879	138.3115	132.5272	127.9000	122.8974	120.8316	124.4905	128.3696	133.6401	139.5193	144.5362	(44)
Energy conte	229.5496	202.1888	212.5797	181.4231	172.1780	151.1167	146.1353	154.1452	158.2926	181.3483	198.7708	226.3088	(45)
Energy content (annual)										Total = Sum(45)m =		2214.0368	

Distribution loss (46)m = 0.15 x (45)m

34.4324	30.3283	31.8870	27.2135	25.8267	22.6675	21.9203	23.1218	23.7439	27.2023	29.8156	33.9463	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
									Total per year (kWh/year) = Sum(64)m =		2461.0688	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

93.1099	82.3881	87.4674	76.5664	74.0338	66.4895	65.3746	68.0379	68.8755	77.0830	82.3345	92.0323	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.5047	19.1002	15.5334	11.7598	8.7906	7.4214	8.0190	10.4234	13.9903	17.7639	20.7331	22.1023	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	278.8333	281.7267	274.4354	258.9131	239.3189	220.9031	208.6002	205.7068	212.9981	228.5205	248.1147	266.5304	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	(71)
Water heating gains (Table 5)	125.1477	122.6013	117.5637	106.3422	99.5078	92.3465	87.8691	91.4488	95.6604	103.6061	114.3535	123.6993	(72)
Total internal gains	518.1243	516.0669	500.1711	469.6536	440.2559	413.3096	397.1270	400.2177	415.2875	442.5292	475.8399	504.9707	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5900	10.6334	0.6300	0.8270	0.7700	13.7831	(74)
Northeast	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(75)
Northwest	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(81)

77.9864	157.0279	280.2162	458.5828	616.6334	657.8250	615.1898	490.0648	340.7231	191.0654	97.7876	63.9219	(83)
596.1107	673.0949	780.3873	928.2365	1056.8893	1071.1345	1012.3168	890.2825	756.0106	633.5945	573.6275	568.8927	(84)

Solar gains
Total gains

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7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
tau	65.2192	65.4245	65.6310	66.6837	66.8983	67.9924	67.9924	68.2156	67.5505	66.8983	66.4705	66.0481	
alpha	5.3479	5.3616	5.3754	5.4456	5.4599	5.5328	5.5328	5.5477	5.5034	5.4599	5.4314	5.4032	
util living area	0.9564	0.9221	0.8321	0.6453	0.4495	0.3022	0.2200	0.2606	0.4614	0.7660	0.9229	0.9636	(86)
MIT	20.3161	20.5022	20.7554	20.9435	20.9923	20.9993	20.9999	20.9998	20.9938	20.8900	20.5801	20.2790	(87)
Th 2	20.2493	20.2515	20.2537	20.2647	20.2668	20.2778	20.2778	20.2800	20.2734	20.2668	20.2625	20.2581	(88)
util rest of house	0.9481	0.9087	0.8082	0.6119	0.4151	0.2682	0.1839	0.2199	0.4142	0.7281	0.9074	0.9566	(89)
MIT 2	19.4695	19.6983	19.9978	20.2117	20.2607	20.2774	20.2778	20.2799	20.2692	20.1646	19.8065	19.4308	(90)
Living area fraction									fLA = Living area / (4) =			0.4663	(91)
MIT	19.8643	20.0732	20.3511	20.5529	20.6018	20.6141	20.6145	20.6156	20.6071	20.5029	20.1672	19.8263	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8643	20.0732	20.3511	20.5529	20.6018	20.6141	20.6145	20.6156	20.6071	20.5029	20.1672	19.8263	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9432	0.9051	0.8115	0.6252	0.4309	0.2841	0.2008	0.2389	0.4360	0.7408	0.9052	0.9518	(94)
Useful gains	562.2669	609.2454	633.2846	580.3266	455.3638	304.2892	203.2361	212.6837	329.6093	469.3767	519.2315	541.4589	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	821.5389	798.3836	726.5236	601.5746	458.0786	304.4963	203.2586	212.7413	331.6152	509.5911	676.7523	814.4634	(97)
Space heating kWh	192.8983	127.1009	69.3698	15.2986	2.0198	0.0000	0.0000	0.0000	0.0000	29.9195	113.4150	203.1154	(98a)
Space heating requirement - total per year (kWh/year)												753.1373	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	192.8983	127.1009	69.3698	15.2986	2.0198	0.0000	0.0000	0.0000	0.0000	29.9195	113.4150	203.1154	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												753.1373	
Space heating per m2										(98c) / (4) =		11.4808	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	192.8983	127.1009	69.3698	15.2986	2.0198	0.0000	0.0000	0.0000	0.0000	29.9195	113.4150	203.1154	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	192.8983	127.1009	69.3698	15.2986	2.0198	0.0000	0.0000	0.0000	0.0000	29.9195	113.4150	203.1154	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	12.1045	10.9331	12.1045	11.7141	12.1045	11.7141	12.1045	12.1045	11.7141	12.1045	11.7141	12.1045	(231)
Lighting	18.8229	15.1004	13.5963	9.9612	7.6943	6.2863	7.0190	9.1236	11.8506	15.5487	17.5622	19.3460	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.9383	-25.4060	-41.0373	-51.0655	-59.6767	-57.3843	-56.4723	-50.9617	-41.6122	-30.6586	-18.3592	-13.4249	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.7963	-6.7109	-15.5603	-26.9401	-38.1174	-39.2360	-38.6794	-31.3088	-21.3818	-10.9508	-4.0400	-2.1284	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	753.1373	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2461.0688	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	142.5210	(230a)
Total electricity for the above, kWh/year	142.5210	(231)
Electricity for lighting (calculated in Appendix L)	151.9116	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-699.8470	(233)
Wind generation	0.0000	(234)

Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2808.7917	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	753.1373	16.4900	124.1923	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	16.4900	405.8302	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	142.5210	16.4900	23.5017	(249)
Energy for lighting	151.9116	16.4900	25.0502	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-461.9969	16.4900	-76.1833	
PV Unit electricity exported	-237.8500	5.5900	-13.2958	
Total			-89.4791	(252)
Total energy cost			489.0954	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.5920	(257)
SAP value		74.1938	
SAP rating (Section 12)		74	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	753.1373	0.1582	119.1490	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2461.0688	0.1413	347.7259	(264)
Space and water heating			466.8749	(265)
Pumps, fans and electric keep-hot	142.5210	0.1387	19.7694	(267)
Energy for lighting	151.9116	0.1443	21.9255	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-461.9969	0.1324	-61.1903	
PV Unit electricity exported	-237.8500	0.1227	-29.1797	
Total			-90.3700	(269)
Total CO2, kg/year			418.1999	(272)
CO2 emissions per m2			6.3700	(273)
EI value			94.9332	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		65.6000 (1b)	x	2.4000 (2b)	=	157.4400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.6000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	157.4400	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.3500	1.2357	23.9116			(27)
Floor to heated Ent			65.6000	0.0600	3.9360	75.0000	4920.0000	(28a)
External Wall 1	41.2300	19.3500	21.8800	0.1400	3.0632	14.0000	306.3200	(29a)
Total net area of external elements Aum(A, m2)			106.8300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.9108			(33)
Party Wall 1			30.2400	0.0000	0.0000	20.0000	604.8000	(32)
Wall to corridor			14.1800	0.0000	0.0000	20.0000	283.6000	(32)
Party Ceiling 1			65.6000			80.0000	5248.0000	(32b)
Internal Wall 1			114.4800			9.0000	1030.3200	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12393.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 188.9183 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E5 Ground floor (normal)	15.2700	0.1600	2.4432
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P1 Party wall - Ground floor	16.4500	0.0800	1.3160
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.1532 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 37.0640 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.8853	15.8853	15.5541	14.5604	14.3948	13.7324	13.4012	13.4012	14.0636	14.8917	15.2229	15.0573	(38)
Heat transfer coeff	52.9493	52.9493	52.6181	51.6244	51.4588	50.7964	50.4652	50.4652	51.1276	51.9557	52.2869	52.1213	(39)
Average = Sum(39)m / 12 =												51.7348	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8072	0.8072	0.8021	0.7870	0.7844	0.7743	0.7693	0.7693	0.7794	0.7920	0.7971	0.7945	(40)
HLP (average)												0.7886	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1348 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	82.5173	81.2772	79.4702	76.0128	73.4613	70.6159	68.9985	70.7919	72.7577	75.8128	79.3445	82.2011	(42a)
Hot water usage for baths	25.9306	25.5455	25.0032	24.0033	23.2545	22.4243	21.9759	22.5144	23.1007	23.9891	25.0096	25.8429	(42b)
Hot water usage for other uses	36.4921	35.1651	33.8381	32.5112	31.1842	29.8572	29.8572	31.1842	32.5112	33.8381	35.1651	36.4921	(42c)
Average daily hot water use (litres/day)												133.2946	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.9400	141.9879	138.3115	132.5272	127.9000	122.8974	120.8316	124.4905	128.3696	133.6401	139.5193	144.5362	(44)
Energy conte	229.5496	202.1888	212.5797	181.4231	172.1780	151.1167	146.1353	154.1452	158.2926	181.3483	198.7708	226.3088	(45)
Energy content (annual)										Total = Sum(45)m =		2214.0368	
Distribution loss (46)m = 0.15 x (45)m	34.4324	30.3283	31.8870	27.2135	25.8267	22.6675	21.9203	23.1218	23.7439	27.2023	29.8156	33.9463	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
										Total per year (kWh/year) = Sum(64)m =		2461.0688	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	93.1099	82.3881	87.4674	76.5664	74.0338	66.4895	65.3746	68.0379	68.8755	77.0830	82.3345	92.0323	(65)

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5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.5047	19.1002	15.5334	11.7598	8.7906	7.4214	8.0190	10.4234	13.9903	17.7639	20.7331	22.1023	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	278.8333	281.7267	274.4354	258.9131	239.3189	220.9031	208.6002	205.7068	212.9981	228.5205	248.1147	266.5304	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	(71)
Water heating gains (Table 5)													
	125.1477	122.6013	117.5637	106.3422	99.5078	92.3465	87.8691	91.4488	95.6604	103.6061	114.3535	123.6993	(72)
Total internal gains													
	518.1243	516.0669	500.1711	469.6536	440.2559	413.3096	397.1270	400.2177	415.2875	442.5292	475.8399	504.9707	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5900	9.5462	0.6300	0.8270	0.7700	12.3738	(74)
Northeast	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(75)
Northwest	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(81)

Solar gains	69.4528	148.6778	276.6041	477.3240	638.3689	663.6861	627.6104	484.0300	333.4428	179.5688	89.3871	58.2939	(83)
Total gains	587.5771	664.7447	776.7752	946.9776	1078.6248	1076.9957	1024.7374	884.2477	748.7303	622.0980	565.2270	563.2647	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	65.0152	65.0152	65.4245	66.6837	66.8983	67.7708	68.2156	68.2156	67.3317	66.2586	65.8389	66.0481	
alpha	5.3343	5.3343	5.3616	5.4456	5.4599	5.5181	5.5477	5.5477	5.4888	5.4172	5.3893	5.4032	
util living area													
	0.9626	0.9352	0.8601	0.6773	0.4862	0.3670	0.3001	0.3531	0.5495	0.8187	0.9367	0.9689	(86)
MIT	20.2540	20.4236	20.6874	20.9230	20.9876	20.9978	20.9994	20.9986	20.9827	20.8286	20.5082	20.2163	(87)
Th 2	20.2471	20.2471	20.2515	20.2647	20.2668	20.2756	20.2800	20.2800	20.2712	20.2603	20.2559	20.2581	(88)
util rest of house													
	0.9555	0.9239	0.8396	0.6462	0.4530	0.3332	0.2648	0.3124	0.5039	0.7867	0.9237	0.9630	(89)
MIT 2	19.3904	19.5986	19.9166	20.1900	20.2563	20.2740	20.2797	20.2792	20.2579	20.0927	19.7140	19.3521	(90)
Living area fraction									fLA = Living area / (4) =			0.4663	(91)
MIT	19.7931	19.9833	20.2760	20.5318	20.5973	20.6115	20.6153	20.6146	20.5959	20.4359	20.0843	19.7551	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7931	19.9833	20.2760	20.5318	20.5973	20.6115	20.6153	20.6146	20.5959	20.4359	20.0843	19.7551	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9505	0.9195	0.8403	0.6577	0.4680	0.3489	0.2813	0.3314	0.5244	0.7947	0.9203	0.9582	(94)
Useful gains	558.4931	611.2008	652.7404	622.8412	504.8005	375.7364	288.2402	293.0057	392.6284	494.3818	520.2012	539.7088	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	841.5306	830.4188	772.2241	652.1116	509.3040	376.4787	288.4231	293.4373	398.5838	557.7899	705.0532	836.8110	(97)
Space heating kWh													
	210.5799	147.3145	88.8959	21.0747	3.3506	0.0000	0.0000	0.0000	0.0000	47.1756	133.0934	221.0440	(98a)
Space heating requirement - total per year (kWh/year)												872.5286	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	210.5799	147.3145	88.8959	21.0747	3.3506	0.0000	0.0000	0.0000	0.0000	47.1756	133.0934	221.0440	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												872.5286	
Space heating per m2											(98c) / (4) =	13.3007	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	210.5799	147.3145	88.8959	21.0747	3.3506	0.0000	0.0000	0.0000	0.0000	47.1756	133.0934	221.0440	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	210.5799	147.3145	88.8959	21.0747	3.3506	0.0000	0.0000	0.0000	0.0000	47.1756	133.0934	221.0440	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
Efficiency of water heater												100.0000	(216)

(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	12.1045	10.9331	12.1045	11.7141	12.1045	11.7141	12.1045	12.1045	11.7141	12.1045	11.7141	12.1045	(231)
Lighting	18.8229	15.1004	13.5963	9.9612	7.6943	6.2863	7.0190	9.1236	11.8506	15.5487	17.5622	19.3460	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.4391	-24.5137	-41.2594	-53.3867	-61.8318	-58.2186	-57.7804	-50.9772	-41.3377	-29.5296	-17.1024	-12.4102	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.3520	-6.1877	-15.3189	-28.8859	-40.6193	-40.3248	-40.3981	-31.3264	-21.1298	-10.0070	-3.5235	-1.8501	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	872.5286	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2461.0688	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	142.5210	(230a)
Total electricity for the above, kWh/year	142.5210	(231)
Electricity for lighting (calculated in Appendix L)	151.9116	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-704.7104	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2923.3195	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	872.5286	25.1600	219.5282	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	25.1600	619.2049	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	142.5210	25.1600	35.8583	(249)
Energy for lighting	151.9116	25.1600	38.2210	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-462.7868	25.1600	-116.4372	
PV Unit electricity exported	-241.9235	5.8100	-14.0558	
Total			-130.4929	(252)
Total energy cost			782.3194	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	872.5286	0.1576	137.4950	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2461.0688	0.1413	347.7259	(264)
Space and water heating			485.2210	(265)
Pumps, fans and electric keep-hot	142.5210	0.1387	19.7694	(267)
Energy for lighting	151.9116	0.1443	21.9255	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-462.7868	0.1322	-61.1584	
PV Unit electricity exported	-241.9235	0.1221	-29.5465	
Total			-90.7049	(269)
Total CO2, kg/year			436.2110	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	872.5286	1.5833	1381.5025	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	1.5225	3746.8812	(278)
Space and water heating			5128.3837	(279)
Pumps, fans and electric keep-hot	142.5210	1.5128	215.6057	(281)
Energy for lighting	151.9116	1.5338	233.0071	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-462.7868	1.4883	-688.7586	
PV Unit electricity exported	-241.9235	0.4482	-108.4276	
Total			-797.1862	(283)
Total Primary energy kWh/year			4779.8103	(286)

SAP 10 EPC IMPROVEMENTS

Unit 287 L01_Copy

Current energy efficiency rating: C 74
Current environmental impact rating: A 95

N Solar water heating	Not applicable
U Solar photovoltaic panels	Not applicable
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 74
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£913	£913	£0
Space heating	£255	£255	£0
Water heating	£619	£619	£0
Lighting	£38	£38	£0
Generated (PV)	-£130	-£130	£0
Total cost of fuels	£783	£783	£0
Total cost of uses	£782	£782	£0
Delivered energy	45 kWh/m²	45 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	7 kg/m²	7 kg/m²	0 kg/m²
Primary energy	73 kWh/m²	73 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.6000 (1b)	x	2.4000 (2b)	=	157.4400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	157.4400	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.3500	1.2357	23.9116			(27)
Floor to heated Ent			65.6000	0.0600	3.9360	75.0000	4920.0000	(28a)
External Wall 1	41.2300	19.3500	21.8800	0.1400	3.0632	14.0000	306.3200	(29a)
Total net area of external elements Aum(A, m2)			106.8300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.9108			(33)
Party Wall 1			30.2400	0.0000	0.0000	20.0000	604.8000	(32)
Wall to corridor			14.1800	0.0000	0.0000	20.0000	283.6000	(32)
Party Ceiling 1			65.6000			80.0000	5248.0000	(32b)
Internal Wall 1			114.4800			9.0000	1030.3200	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12393.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 188.9183 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E5 Ground floor (normal)	15.2700	0.1600	2.4432
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P1 Party wall - Ground floor	16.4500	0.0800	1.3160
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.1532 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 37.0640 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.7197	15.5541	15.3885	14.5604	14.3948	13.5668	13.5668	13.4012	13.8980	14.3948	14.7261	15.0573	(38)
Heat transfer coeff	52.7837	52.6181	52.4525	51.6244	51.4588	50.6308	50.6308	50.4652	50.9620	51.4588	51.7900	52.1213	(39)

Average = Sum(39)m / 12 = 51.5830

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8046	0.8021	0.7996	0.7870	0.7844	0.7718	0.7718	0.7693	0.7769	0.7844	0.7895	0.7945	(40)
HLP (average)												0.7863	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1348 (42)
Hot water usage for mixer showers

82.5173	81.2772	79.4702	76.0128	73.4613	70.6159	68.9985	70.7919	72.7577	75.8128	79.3445	82.2011	(42a)

Hot water usage for baths

25.9306	25.5455	25.0032	24.0033	23.2545	22.4243	21.9759	22.5144	23.1007	23.9891	25.0096	25.8429	(42b)

Hot water usage for other uses

36.4921	35.1651	33.8381	32.5112	31.1842	29.8572	29.8572	31.1842	32.5112	33.8381	35.1651	36.4921	(42c)

Average daily hot water use (litres/day) 133.2946 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.9400	141.9879	138.3115	132.5272	127.9000	122.8974	120.8316	124.4905	128.3696	133.6401	139.5193	144.5362	(44)
Energy conte	229.5496	202.1888	212.5797	181.4231	172.1780	151.1167	146.1353	154.1452	158.2926	181.3483	198.7708	226.3088	(45)
Energy content (annual)										Total = Sum(45)m =		2214.0368	
Distribution loss (46)m = 0.15 x (45)m	34.4324	30.3283	31.8870	27.2135	25.8267	22.6675	21.9203	23.1218	23.7439	27.2023	29.8156	33.9463	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)

Total per year (kWh/year) = Sum(64)m = 2461.0688 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

93.1099	82.3881	87.4674	76.5664	74.0338	66.4895	65.3746	68.0379	68.8755	77.0830	82.3345	92.0323	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.5047	19.1002	15.5334	11.7598	8.7906	7.4214	8.0190	10.4234	13.9903	17.7639	20.7331	22.1023	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	278.8333	281.7267	274.4354	258.9131	239.3189	220.9031	208.6002	205.7068	212.9981	228.5205	248.1147	266.5304	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	(71)
Water heating gains (Table 5)	125.1477	122.6013	117.5637	106.3422	99.5078	92.3465	87.8691	91.4488	95.6604	103.6061	114.3535	123.6993	(72)

Total internal gains

	518.1243	516.0669	500.1711	469.6536	440.2559	413.3096	397.1270	400.2177	415.2875	442.5292	475.8399	504.9707 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5900	10.6334	0.6300	0.8270	0.7700	13.7831	(74)
Northeast	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(75)
Northwest	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(81)

Solar gains	77.9864	157.0279	280.2162	458.5828	616.6334	657.8250	615.1898	490.0648	340.7231	191.0654	97.7876	63.9219	(83)
Total gains	596.1107	673.0949	780.3873	928.2365	1056.8893	1071.1345	1012.3168	890.2825	756.0106	633.5945	573.6275	568.8927	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	65.2192	65.4245	65.6310	66.6837	66.8983	67.9924	67.9924	68.2156	67.5505	66.8983	66.4705	66.0481	
alpha	5.3479	5.3616	5.3754	5.4456	5.4599	5.5328	5.5328	5.5477	5.5034	5.4599	5.4314	5.4032	
util living area	0.9564	0.9221	0.8321	0.6453	0.4495	0.3022	0.2200	0.2606	0.4614	0.7660	0.9229	0.9636	(86)
MIT	20.3161	20.5022	20.7554	20.9435	20.9923	20.9993	20.9999	20.9998	20.9938	20.8900	20.5801	20.2790	(87)
Th 2	20.2493	20.2515	20.2537	20.2647	20.2668	20.2778	20.2778	20.2800	20.2734	20.2668	20.2625	20.2581	(88)
util rest of house	0.9481	0.9087	0.8082	0.6119	0.4151	0.2682	0.1839	0.2199	0.4142	0.7281	0.9074	0.9566	(89)
MIT 2	19.4695	19.6983	19.9978	20.2117	20.2607	20.2774	20.2778	20.2799	20.2692	20.1646	19.8065	19.4308	(90)
Living area fraction									fLA = Living area / (4) =			0.4663	(91)
MIT	19.8643	20.0732	20.3511	20.5529	20.6018	20.6141	20.6145	20.6156	20.6071	20.5029	20.1672	19.8263	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8643	20.0732	20.3511	20.5529	20.6018	20.6141	20.6145	20.6156	20.6071	20.5029	20.1672	19.8263	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9432	0.9051	0.8115	0.6252	0.4309	0.2841	0.2008	0.2389	0.4360	0.7408	0.9052	0.9518	(94)
Useful gains	562.2669	609.2454	633.2846	580.3266	455.3638	304.2892	203.2361	212.6837	329.6093	469.3767	519.2315	541.4589	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	821.5389	798.3836	726.5236	601.5746	458.0786	304.4963	203.2586	212.7413	331.6152	509.5911	676.7523	814.4634	(97)
Space heating kWh	192.8983	127.1009	69.3698	15.2986	2.0198	0.0000	0.0000	0.0000	0.0000	29.9195	113.4150	203.1154	(98a)
Space heating requirement - total per year (kWh/year)												753.1373	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	192.8983	127.1009	69.3698	15.2986	2.0198	0.0000	0.0000	0.0000	0.0000	29.9195	113.4150	203.1154	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												753.1373	
Space heating per m2										(98c) / (4) =		11.4808	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	192.8983	127.1009	69.3698	15.2986	2.0198	0.0000	0.0000	0.0000	0.0000	29.9195	113.4150	203.1154	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	192.8983	127.1009	69.3698	15.2986	2.0198	0.0000	0.0000	0.0000	0.0000	29.9195	113.4150	203.1154	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	12.1045	10.9331	12.1045	11.7141	12.1045	11.7141	12.1045	12.1045	11.7141	12.1045	11.7141	12.1045	(231)
Lighting	18.8229	15.1004	13.5963	9.9612	7.6943	6.2863	7.0190	9.1236	11.8506	15.5487	17.5622	19.3460	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.9383	-25.4060	-41.0373	-51.0655	-59.6767	-57.3843	-56.4723	-50.9617	-41.6122	-30.6586	-18.3592	-13.4249	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													

(233b)m	-2.7963	-6.7109	-15.5603	-26.9401	-38.1174	-39.2360	-38.6794	-31.3088	-21.3818	-10.9508	-4.0400	-2.1284	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	753.1373	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2461.0688	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	142.5210	(230a)
Total electricity for the above, kWh/year	142.5210	(231)
Electricity for lighting (calculated in Appendix L)	151.9116	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-699.8470	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2808.7917	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	753.1373	16.4900	124.1923	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	16.4900	405.8302	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	142.5210	16.4900	23.5017	(249)
Energy for lighting	151.9116	16.4900	25.0502	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-461.9969	16.4900	-76.1833	
PV Unit electricity exported	-237.8500	5.5900	-13.2958	
Total			-89.4791	(252)
Total energy cost			489.0954	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.5920	(257)
SAP value		74.1938	
SAP rating (Section 12)		74	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	753.1373	0.1582	119.1490	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2461.0688	0.1413	347.7259	(264)
Space and water heating			466.8749	(265)
Pumps, fans and electric keep-hot	142.5210	0.1387	19.7694	(267)
Energy for lighting	151.9116	0.1443	21.9255	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-461.9969	0.1324	-61.1903	
PV Unit electricity exported	-237.8500	0.1227	-29.1797	
Total			-90.3700	(269)
Total CO2, kg/year			418.1999	(272)
CO2 emissions per m2			6.3700	(273)
EI value			94.9332	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		65.6000 (1b)	x	2.4000 (2b)	=	157.4400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.6000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	157.4400	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.3500	1.2357	23.9116			(27)
Floor to heated Ent			65.6000	0.0600	3.9360	75.0000	4920.0000	(28a)
External Wall 1	41.2300	19.3500	21.8800	0.1400	3.0632	14.0000	306.3200	(29a)
Total net area of external elements Aum(A, m2)			106.8300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.9108			(33)
Party Wall 1			30.2400	0.0000	0.0000	20.0000	604.8000	(32)
Wall to corridor			14.1800	0.0000	0.0000	20.0000	283.6000	(32)
Party Ceiling 1			65.6000			80.0000	5248.0000	(32b)
Internal Wall 1			114.4800			9.0000	1030.3200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12393.0400	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		188.9183	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E5 Ground floor (normal)	15.2700	0.1600	2.4432
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P1 Party wall - Ground floor	16.4500	0.0800	1.3160
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.1532	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	37.0640	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.8853	15.8853	15.5541	14.5604	14.3948	13.7324	13.4012	13.4012	14.0636	14.8917	15.2229	15.0573	(38)
Heat transfer coeff	52.9493	52.9493	52.6181	51.6244	51.4588	50.7964	50.4652	50.4652	51.1276	51.9557	52.2869	52.1213	(39)
Average = Sum(39)m / 12 =												51.7348	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8072	0.8072	0.8021	0.7870	0.7844	0.7743	0.7693	0.7693	0.7794	0.7920	0.7971	0.7945	(40)
HLP (average)												0.7886	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1348	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	82.5173	81.2772	79.4702	76.0128	73.4613	70.6159	68.9985	70.7919	72.7577	75.8128	79.3445	82.2011	(42a)
Hot water usage for baths	25.9306	25.5455	25.0032	24.0033	23.2545	22.4243	21.9759	22.5144	23.1007	23.9891	25.0096	25.8429	(42b)
Hot water usage for other uses	36.4921	35.1651	33.8381	32.5112	31.1842	29.8572	29.8572	31.1842	32.5112	33.8381	35.1651	36.4921	(42c)
Average daily hot water use (litres/day)												133.2946	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.9400	141.9879	138.3115	132.5272	127.9000	122.8974	120.8316	124.4905	128.3696	133.6401	139.5193	144.5362	(44)
Energy conte	229.5496	202.1888	212.5797	181.4231	172.1780	151.1167	146.1353	154.1452	158.2926	181.3483	198.7708	226.3088	(45)
Energy content (annual)										Total = Sum(45)m =		2214.0368	
Distribution loss (46)m = 0.15 x (45)m	34.4324	30.3283	31.8870	27.2135	25.8267	22.6675	21.9203	23.1218	23.7439	27.2023	29.8156	33.9463	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)

Total per year (kWh/year) = Sum(64)m = 2461.0688 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

93.1099	82.3881	87.4674	76.5664	74.0338	66.4895	65.3746	68.0379	68.8755	77.0830	82.3345	92.0323	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

21.5047	19.1002	15.5334	11.7598	8.7906	7.4214	8.0190	10.4234	13.9903	17.7639	20.7331	22.1023	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

278.8333	281.7267	274.4354	258.9131	239.3189	220.9031	208.6002	205.7068	212.9981	228.5205	248.1147	266.5304	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	(71)

Water heating gains (Table 5)

125.1477	122.6013	117.5637	106.3422	99.5078	92.3465	87.8691	91.4488	95.6604	103.6061	114.3535	123.6993	(72)

Total internal gains

518.1243	516.0669	500.1711	469.6536	440.2559	413.3096	397.1270	400.2177	415.2875	442.5292	475.8399	504.9707	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5900	9.5462	0.6300	0.8270	0.7700	12.3738	(74)
Northeast	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(75)
Northwest	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(81)

Solar gains 69.4528	148.6778	276.6041	477.3240	638.3689	663.6861	627.6104	484.0300	333.4428	179.5688	89.3871	58.2939	(83)
Total gains 587.5771	664.7447	776.7752	946.9776	1078.6248	1076.9957	1024.7374	884.2477	748.7303	622.0980	565.2270	563.2647	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	65.0152	65.0152	65.4245	66.6837	66.8983	67.7708	68.2156	68.2156	67.3317	66.2586	65.8389	66.0481	
alpha	5.3343	5.3343	5.3616	5.4456	5.4599	5.5181	5.5477	5.5477	5.4888	5.4172	5.3893	5.4032	
util living area													
	0.9626	0.9352	0.8601	0.6773	0.4862	0.3670	0.3001	0.3531	0.5495	0.8187	0.9367	0.9689	(86)
MIT	20.2540	20.4236	20.6874	20.9230	20.9876	20.9978	20.9994	20.9986	20.9827	20.8286	20.5082	20.2163	(87)
Th 2	20.2471	20.2471	20.2515	20.2647	20.2668	20.2756	20.2800	20.2800	20.2712	20.2603	20.2559	20.2581	(88)
util rest of house													
	0.9555	0.9239	0.8396	0.6462	0.4530	0.3332	0.2648	0.3124	0.5039	0.7867	0.9237	0.9630	(89)
MIT 2	19.3904	19.5986	19.9166	20.1900	20.2563	20.2740	20.2797	20.2792	20.2579	20.0927	19.7140	19.3521	(90)
Living area fraction									fLA = Living area / (4) =			0.4663	(91)
MIT	19.7931	19.9833	20.2760	20.5318	20.5973	20.6115	20.6153	20.6146	20.5959	20.4359	20.0843	19.7551	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7931	19.9833	20.2760	20.5318	20.5973	20.6115	20.6153	20.6146	20.5959	20.4359	20.0843	19.7551	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9505	0.9195	0.8403	0.6577	0.4680	0.3489	0.2813	0.3314	0.5244	0.7947	0.9203	0.9582	(94)
Useful gains	558.4931	611.2008	652.7404	622.8412	504.8005	375.7364	288.2402	293.0057	392.6284	494.3818	520.2012	539.7088	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	841.5306	830.4188	772.2241	652.1116	509.3040	376.4787	288.4231	293.4373	398.5838	557.7899	705.0532	836.8110	(97)
Space heating kWh													
	210.5799	147.3145	88.8959	21.0747	3.3506	0.0000	0.0000	0.0000	0.0000	47.1756	133.0934	221.0440	(98a)

Space heating requirement - total per year (kWh/year) 872.5286

Solar heating kWh

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)

Solar heating contribution - total per year (kWh/year) 0.0000

Space heating kWh

210.5799	147.3145	88.8959	21.0747	3.3506	0.0000	0.0000	0.0000	0.0000	47.1756	133.0934	221.0440	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 872.5286

Space heating per m2 (98c) / (4) = 13.3007 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	210.5799	147.3145	88.8959	21.0747	3.3506	0.0000	0.0000	0.0000	0.0000	47.1756	133.0934	221.0440	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	210.5799	147.3145	88.8959	21.0747	3.3506	0.0000	0.0000	0.0000	0.0000	47.1756	133.0934	221.0440	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	12.1045	10.9331	12.1045	11.7141	12.1045	11.7141	12.1045	12.1045	11.7141	12.1045	11.7141	12.1045	(231)
Lighting	18.8229	15.1004	13.5963	9.9612	7.6943	6.2863	7.0190	9.1236	11.8506	15.5487	17.5622	19.3460	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.4391	-24.5137	-41.2594	-53.3867	-61.8318	-58.2186	-57.7804	-50.9772	-41.3377	-29.5296	-17.1024	-12.4102	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.3520	-6.1877	-15.3189	-28.8859	-40.6193	-40.3248	-40.3981	-31.3264	-21.1298	-10.0070	-3.5235	-1.8501	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												872.5286	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2461.0688	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)													
mechanical ventilation fans (SFP = 0.7420)												142.5210	(230a)
Total electricity for the above, kWh/year												142.5210	(231)
Electricity for lighting (calculated in Appendix L)												151.9116	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-704.7104	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2923.3195	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	872.5286	25.1600	219.5282	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	25.1600	619.2049	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	142.5210	25.1600	35.8583	(249)
Energy for lighting	151.9116	25.1600	38.2210	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-462.7868	25.1600	-116.4372	
PV Unit electricity exported	-241.9235	5.8100	-14.0558	
Total			-130.4929	(252)
Total energy cost			782.3194	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	872.5286	0.1576	137.4950	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2461.0688	0.1413	347.7259	(264)
Space and water heating			485.2210	(265)
Pumps, fans and electric keep-hot	142.5210	0.1387	19.7694	(267)
Energy for lighting	151.9116	0.1443	21.9255	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-462.7868	0.1322	-61.1584	
PV Unit electricity exported	-241.9235	0.1221	-29.5465	
Total			-90.7049	(269)
Total CO2, kg/year			436.2110	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	872.5286	1.5833	1381.5025	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	1.5225	3746.8812	(278)
Space and water heating			5128.3837	(279)
Pumps, fans and electric keep-hot	142.5210	1.5128	215.6057	(281)
Energy for lighting	151.9116	1.5338	233.0071	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-462.7868	1.4883	-688.7586	
PV Unit electricity exported	-241.9235	0.4482	-108.4276	
Total			-797.1862	(283)
Total Primary energy kWh/year			4779.8103	(286)

Predicted Energy Assessment

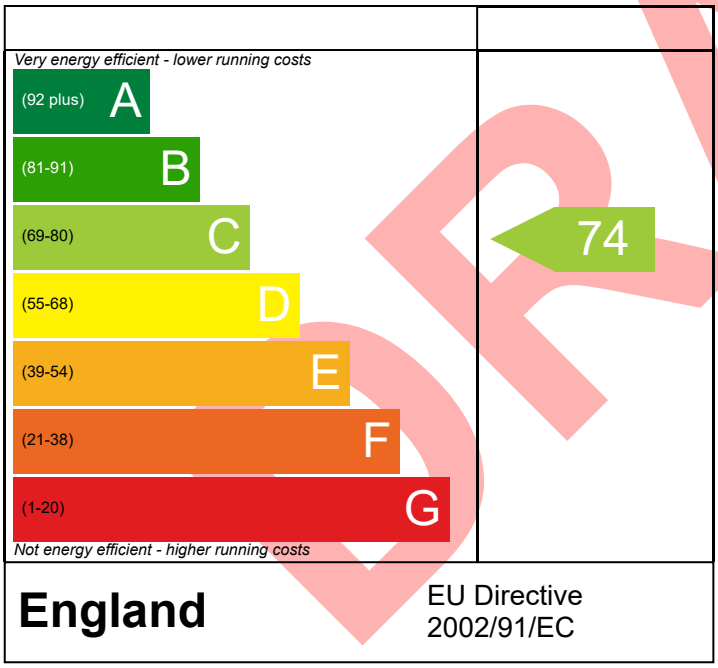
elmhurst energy

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	65.6 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

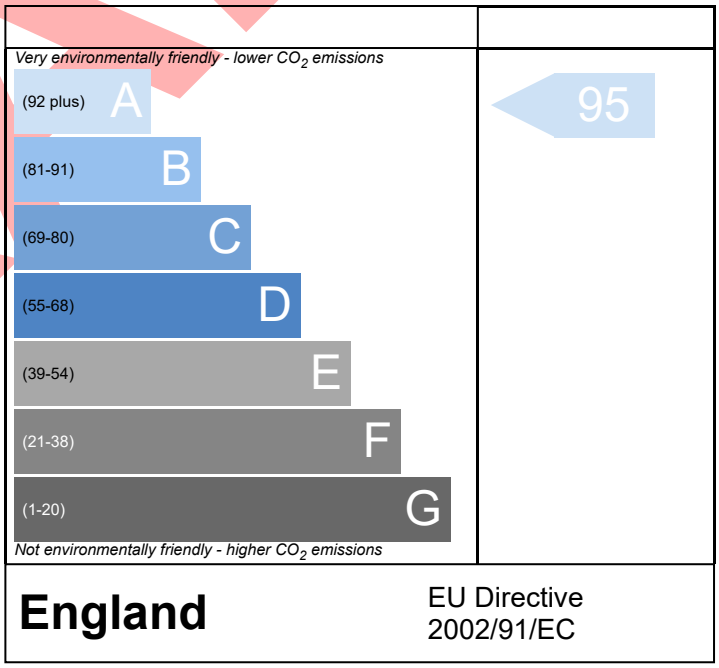
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:52

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	71 m^2
Site Reference	Unit 288 L01 _Copy	Plot Reference	Unit 288 L01_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*12.76 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	5.92 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*68.89 kWh$_{PE}$/m^2*	
Dwelling primary energy	65.3 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*29.5 kWh/m^2*	
Dwelling fabric energy efficiency	27.7 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.12	Heatloss Floor 1 (0.12)	OK
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	11	0.14 **(!)**
Party wall: Party Wall (1)	52.62	0 **(!)**
Party wall: Party Wall (2)	15.55	0 **(!)**
Upper floor: Heatloss Floor 1, Heatloss Floor 1	70.98	0.12

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	11.81	North East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E20: Exposed floor (normal)	Calculated by person with suitable expertise	0.32	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P7: Exposed floor (normal)	Calculated by person with suitable expertise	0.16	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.92 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 288 L01 _Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 288 L01_Copy	**Prop Type Ref**	Unit 288 L01
Property			

SAP Rating	76 C	**DER**	5.92	**TER**	12.76
Environmental	95 A	**% DER < TER**			53.61
CO_2 Emissions (t/year)	0.42	**DFEE**	27.70	**TFEE**	29.46
Compliance Check	See BREL	**% DFEE < TFEE**			5.99
% DPER < TPER	5.22	**DPER**	65.30	**TPER**	68.89

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
Heatloss Floor 1			70.9800	0.1200	8.5176	75.0000	5323.5000	(28b)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			93.7900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.6517			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13756.1700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		193.8035 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545

E4 Jamb	13.9200	0.0500	0.6960	
E20 Exposed floor (normal)	8.4500	0.3200	2.7040	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P7 Party Wall - Exposed floor (normal)	25.2500	0.1600	4.0400	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.0185 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 32.6702 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.2026	16.0392	15.8758	15.0589	14.8955	14.0786	14.0786	13.9153	14.4054	14.8955	15.2223	15.5490	(38)
Heat transfer coeff	48.8728	48.7094	48.5460	47.7291	47.5657	46.7488	46.7488	46.5855	47.0756	47.5657	47.8925	48.2192	(39)

Average = Sum(39)m / 12 = 47.6883

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6885	0.6862	0.6839	0.6724	0.6701	0.6586	0.6586	0.6563	0.6632	0.6701	0.6747	0.6793	(40)
HLP (average)												0.6719	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2697 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day) 138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)

Energy content (annual) Total = Sum(45)m = 2297.5146

Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)

Total per year (kWh/year) = Sum(64)m = 2544.5466 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(75)

Solar gains	48.1118	97.9329	176.4440	289.7718	389.5101	415.2590	388.4663	309.6898	214.9998	119.6818	60.5371	39.2905	(83)
Total gains	594.4583	642.1364	703.7861	784.8198	853.3337	850.5024	806.5649	731.0038	652.3178	585.8947	562.0348	571.6354	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.1859	78.4481	78.7121	80.0593	80.3343	81.7380	81.7380	82.0247	81.1707	80.3343	79.7862	79.2455	
alpha	6.2124	6.2299	6.2475	6.3373	6.3556	6.4492	6.4492	6.4683	6.4114	6.3556	6.3191	6.2830	
util living area	0.9578	0.9318	0.8621	0.7048	0.5145	0.3515	0.2550	0.2931	0.4951	0.7813	0.9248	0.9643	(86)
MIT	20.4951	20.6195	20.8010	20.9499	20.9932	20.9995	21.0000	20.9999	20.9961	20.9242	20.7004	20.4692	(87)
Th 2	20.3510	20.3530	20.3550	20.3652	20.3673	20.3775	20.3775	20.3796	20.3734	20.3673	20.3632	20.3591	(88)
util rest of house	0.9500	0.9201	0.8417	0.6741	0.4807	0.3174	0.2189	0.2536	0.4512	0.7470	0.9102	0.9575	(89)
MIT 2	19.7742	19.9278	20.1443	20.3174	20.3618	20.3772	20.3775	20.3795	20.3708	20.2964	20.0375	19.7492	(90)
Living area fraction										fLA = Living area / (4) =		0.4060	(91)
MIT	20.0669	20.2086	20.4109	20.5742	20.6181	20.6299	20.6302	20.6314	20.6247	20.5513	20.3066	20.0415	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0669	20.2086	20.4109	20.5742	20.6181	20.6299	20.6302	20.6314	20.6247	20.5513	20.3066	20.0415	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9461	0.9172	0.8436	0.6844	0.4941	0.3313	0.2336	0.2696	0.4689	0.7574	0.9087	0.9537	(94)
Useful gains	562.4257	588.9574	593.7134	537.1362	421.6727	281.7387	188.3968	197.0923	305.8493	443.7397	510.7434	545.1532	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	770.5718	745.6733	675.3189	557.1999	424.1982	281.8909	188.4090	197.1223	307.1536	473.3393	632.4992	763.8658	(97)
Space heating kWh	154.8607	105.3131	60.7145	14.4458	1.8790	0.0000	0.0000	0.0000	0.0000	22.0221	87.6641	162.7222	(98a)
Space heating requirement - total per year (kWh/year)												609.6215	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	154.8607	105.3131	60.7145	14.4458	1.8790	0.0000	0.0000	0.0000	0.0000	22.0221	87.6641	162.7222	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												609.6215	
Space heating per m2											(98c) / (4) =	8.5886	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	154.8607	105.3131	60.7145	14.4458	1.8790	0.0000	0.0000	0.0000	0.0000	22.0221	87.6641	162.7222	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	154.8607	105.3131	60.7145	14.4458	1.8790	0.0000	0.0000	0.0000	0.0000	22.0221	87.6641	162.7222	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)
Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-17.1096	-27.2401	-44.0413	-54.8721	-64.0919	-61.6099	-60.6290	-54.7463	-44.7493	-32.9206	-19.6959	-14.4169	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.1679	-7.5216	-17.2174	-29.5575	-41.7559	-42.9674	-42.3587	-34.2994	-23.4325	-12.1154	-4.5480	-2.4172	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	609.6215	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2544.5466	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	154.2094	(230a)
Total electricity for the above, kWh/year	154.2094	(231)
Electricity for lighting (calculated in Appendix L)	163.7369	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-757.4814	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2714.6330	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	609.6215	16.4900	100.5266	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	16.4900	419.5957	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	16.4900	25.4291	(249)
Energy for lighting	163.7369	16.4900	27.0002	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-496.1227	16.4900	-81.8106	
PV Unit electricity exported	-261.3588	5.5900	-14.6100	
Total			-96.4206	(252)
Total energy cost			476.1311	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.4779	(257)
SAP value		76.0432	
SAP rating (Section 12)		76	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	609.6215	0.1582	96.4515	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			455.9961	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-496.1227	0.1324	-65.7077	
PV Unit electricity exported	-261.3588	0.1228	-32.1075	
Total			-97.8152	(269)
Total CO2, kg/year			403.2039	(272)
CO2 emissions per m2			5.6800	(273)
EI value			95.3415	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
Heatloss Floor 1			70.9800	0.1200	8.5176	75.0000	5323.5000	(28b)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			93.7900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.6517			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 13756.1700	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	193.8035	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E20 Exposed floor (normal)	8.4500	0.3200	2.7040
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P7 Party Wall - Exposed floor (normal)	25.2500	0.1600	4.0400

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.0185	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	32.6702	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3659	16.3659	16.0392	15.0589	14.8955	14.2420	13.9153	13.9153	14.5688	15.3857	15.7124	15.5490	(38)
Heat transfer coeff	49.0361	49.0361	48.7094	47.7291	47.5657	46.9122	46.5855	46.5855	47.2390	48.0559	48.3826	48.2192	(39)
Average = Sum(39)m / 12 =												47.8380	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6908	0.6908	0.6862	0.6724	0.6701	0.6609	0.6563	0.6563	0.6655	0.6770	0.6816	0.6793	(40)
HLP (average)												0.6740	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2697	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)
Average daily hot water use (litres/day)												138.3203	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
										Total per year (kWh/year) = Sum(64)m =		2544.5466	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)													
	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains													
	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(75)

Solar gains	42.7730	92.6022	174.0550	301.5827	403.2921	419.0362	396.3745	305.8819	210.3213	112.3593	55.2465	35.7661	(83)
Total gains	589.1195	636.8057	701.3971	796.6307	867.1157	854.2796	814.4731	727.1958	647.6393	578.5722	556.7443	568.1110	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	77.9254	77.9254	78.4481	80.0593	80.3343	81.4534	82.0247	82.0247	80.8899	79.5149	78.9779	79.2455	
alpha	6.1950	6.1950	6.2299	6.3373	6.3556	6.4302	6.4683	6.4683	6.3927	6.3010	6.2652	6.2830	
util living area													
	0.9637	0.9440	0.8889	0.7411	0.5584	0.4273	0.3487	0.3966	0.5889	0.8342	0.9387	0.9696	(86)
MIT	20.4464	20.5548	20.7407	20.9284	20.9882	20.9981	20.9996	20.9991	20.9877	20.8761	20.6432	20.4190	(87)
Th 2	20.3489	20.3489	20.3530	20.3652	20.3673	20.3755	20.3796	20.3796	20.3714	20.3612	20.3571	20.3591	(88)
util rest of house													
	0.9570	0.9343	0.8719	0.7132	0.5258	0.3934	0.3133	0.3571	0.5466	0.8054	0.9265	0.9639	(89)
MIT 2	19.7120	19.8451	20.0718	20.2945	20.3571	20.3741	20.3793	20.3790	20.3618	20.2392	19.9632	19.6864	(90)
Living area fraction										fLA = Living area / (4) =		0.4060	(91)
MIT	20.0102	20.1333	20.3434	20.5519	20.6133	20.6275	20.6312	20.6308	20.6159	20.4978	20.2393	19.9839	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0102	20.1333	20.3434	20.5519	20.6133	20.6275	20.6312	20.6308	20.6159	20.4978	20.2393	19.9839	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9530	0.9307	0.8716	0.7216	0.5386	0.4071	0.3276	0.3731	0.5632	0.8119	0.9240	0.9600	(94)
Useful gains	561.4353	592.6636	611.3646	574.8102	467.0045	347.7937	266.8569	271.3379	364.7766	469.7390	514.4381	545.3992	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	789.9805	776.4030	718.1423	603.8631	471.5351	348.4404	266.9890	271.6295	369.2166	518.8978	659.9065	785.1955	(97)
Space heating kWh													
	170.0377	123.4729	79.4426	20.9181	3.3708	0.0000	0.0000	0.0000	0.0000	36.5742	104.7373	178.4085	(98a)
Space heating requirement - total per year (kWh/year)												716.9620	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	170.0377	123.4729	79.4426	20.9181	3.3708	0.0000	0.0000	0.0000	0.0000	36.5742	104.7373	178.4085	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												716.9620	
Space heating per m2										(98c) / (4) =		10.1009	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	170.0377	123.4729	79.4426	20.9181	3.3708	0.0000	0.0000	0.0000	0.0000	36.5742	104.7373	178.4085	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	170.0377	123.4729	79.4426	20.9181	3.3708	0.0000	0.0000	0.0000	0.0000	36.5742	104.7373	178.4085	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)

Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.5048	-26.2822	-44.2693	-57.3694	-66.3987	-62.5005	-62.0252	-54.7629	-44.4553	-31.6868	-18.3490	-13.3304	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.6691	-6.9475	-16.9683	-31.6787	-44.4896	-44.1582	-44.2385	-34.3187	-23.1566	-11.1058	-3.9755	-2.1042	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	716.9620	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2544.5466	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	154.2094	(230a)
Total electricity for the above, kWh/year	154.2094	(231)
Electricity for lighting (calculated in Appendix L)	163.7369	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-762.7453	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2816.7097	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	716.9620	25.1600	180.3876	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	25.1600	640.2079	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	25.1600	38.7991	(249)
Energy for lighting	163.7369	25.1600	41.1962	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-496.9346	25.1600	-125.0287	
PV Unit electricity exported	-265.8108	5.8100	-15.4436	
Total			-140.4723	(252)
Total energy cost			760.1185	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	716.9620	0.1575	112.9328	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			472.4773	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-496.9346	0.1321	-65.6689	
PV Unit electricity exported	-265.8108	0.1223	-32.5072	
Total			-98.1761	(269)
Total CO2, kg/year			419.3243	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	716.9620	1.5831	1135.0312	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	1.5225	3874.0629	(278)
Space and water heating			5009.0941	(279)
Pumps, fans and electric keep-hot	154.2094	1.5128	233.2880	(281)
Energy for lighting	163.7369	1.5338	251.1452	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-496.9346	1.4883	-739.5718	
PV Unit electricity exported	-265.8108	0.4488	-119.2938	
Total			-858.8656	(283)
Total Primary energy kWh/year			4634.6617	(286)

SAP 10 EPC IMPROVEMENTS

Unit 288 L01_Copy

Current energy efficiency rating: C 76
Current environmental impact rating: A 95

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 76
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£901	£901	£0
Space heating	£219	£219	£0
Water heating	£640	£640	£0
Lighting	£41	£41	£0
Generated (PV)	-£140	-£140	£0
Total cost of fuels	£761	£761	£0
Total cost of uses	£760	£760	£0
Delivered energy	40 kWh/m²	40 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	65 kWh/m²	65 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
Heatloss Floor 1			70.9800	0.1200	8.5176	75.0000	5323.5000	(28b)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			93.7900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.6517			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13756.1700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		193.8035 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E20 Exposed floor (normal)	8.4500	0.3200	2.7040
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P7 Party Wall - Exposed floor (normal)	25.2500	0.1600	4.0400

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.0185 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	32.6702 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.2026	16.0392	15.8758	15.0589	14.8955	14.0786	14.0786	13.9153	14.4054	14.8955	15.2223	15.5490	(38)
Heat transfer coeff	48.8728	48.7094	48.5460	47.7291	47.5657	46.7488	46.7488	46.5855	47.0756	47.5657	47.8925	48.2192	(39)
Average = Sum(39)m / 12 =												47.6883	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6885	0.6862	0.6839	0.6724	0.6701	0.6586	0.6586	0.6563	0.6632	0.6701	0.6747	0.6793	(40)
HLP (average)												0.6719	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.2697 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)

Hot water usage for baths

26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)

Hot water usage for other uses

37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day)		138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m													
	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
									Total per year (kWh/year) = Sum(64)m =		2544.5466	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast				11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(75)
Solar gains	48.1118	97.9329	176.4440	289.7718	389.5101	415.2590	388.4663	309.6898	214.9998	119.6818	60.5371	39.2905	(83)
Total gains	594.4583	642.1364	703.7861	784.8198	853.3337	850.5024	806.5649	731.0038	652.3178	585.8947	562.0348	571.6354	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.1859	78.4481	78.7121	80.0593	80.3343	81.7380	81.7380	82.0247	81.1707	80.3343	79.7862	79.2455	
alpha	6.2124	6.2299	6.2475	6.3373	6.3556	6.4492	6.4492	6.4683	6.4114	6.3556	6.3191	6.2830	
util living area	0.9578	0.9318	0.8621	0.7048	0.5145	0.3515	0.2550	0.2931	0.4951	0.7813	0.9248	0.9643	(86)
MIT	20.4951	20.6195	20.8010	20.9499	20.9932	20.9995	21.0000	20.9999	20.9961	20.9242	20.7004	20.4692	(87)
Th 2	20.3510	20.3530	20.3550	20.3652	20.3673	20.3775	20.3775	20.3796	20.3734	20.3673	20.3632	20.3591	(88)
util rest of house	0.9500	0.9201	0.8417	0.6741	0.4807	0.3174	0.2189	0.2536	0.4512	0.7470	0.9102	0.9575	(89)
MIT 2	19.7742	19.9278	20.1443	20.3174	20.3618	20.3772	20.3775	20.3795	20.3708	20.2964	20.0375	19.7492	(90)
Living area fraction									fLA = Living area / (4) =			0.4060	(91)
MIT	20.0669	20.2086	20.4109	20.5742	20.6181	20.6299	20.6302	20.6314	20.6247	20.5513	20.3066	20.0415	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0669	20.2086	20.4109	20.5742	20.6181	20.6299	20.6302	20.6314	20.6247	20.5513	20.3066	20.0415	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9461	0.9172	0.8436	0.6844	0.4941	0.3313	0.2336	0.2696	0.4689	0.7574	0.9087	0.9537	(94)
Useful gains	562.4257	588.9574	593.7134	537.1362	421.6727	281.7387	188.3968	197.0923	305.8493	443.7397	510.7434	545.1532	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	770.5718	745.6733	675.3189	557.1999	424.1982	281.8909	188.4090	197.1223	307.1536	473.3393	632.4992	763.8658	(97)
Space heating kWh	154.8607	105.3131	60.7145	14.4458	1.8790	0.0000	0.0000	0.0000	0.0000	22.0221	87.6641	162.7222	(98a)
Space heating requirement - total per year (kWh/year)												609.6215	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	154.8607	105.3131	60.7145	14.4458	1.8790	0.0000	0.0000	0.0000	0.0000	22.0221	87.6641	162.7222	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												609.6215	
Space heating per m2											(98c) / (4) =	8.5886	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	154.8607	105.3131	60.7145	14.4458	1.8790	0.0000	0.0000	0.0000	0.0000	22.0221	87.6641	162.7222	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	154.8607	105.3131	60.7145	14.4458	1.8790	0.0000	0.0000	0.0000	0.0000	22.0221	87.6641	162.7222	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)
Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-17.1096	-27.2401	-44.0413	-54.8721	-64.0919	-61.6099	-60.6290	-54.7463	-44.7493	-32.9206	-19.6959	-14.4169	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.1679	-7.5216	-17.2174	-29.5575	-41.7559	-42.9674	-42.3587	-34.2994	-23.4325	-12.1154	-4.5480	-2.4172	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												609.6215	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2544.5466	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	154.2094	(230a)
Total electricity for the above, kWh/year	154.2094	(231)
Electricity for lighting (calculated in Appendix L)	163.7369	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-757.4814	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2714.6330	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	609.6215	16.4900	100.5266	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	16.4900	419.5957	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	16.4900	25.4291	(249)
Energy for lighting	163.7369	16.4900	27.0002	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-496.1227	16.4900	-81.8106	
PV Unit electricity exported	-261.3588	5.5900	-14.6100	
Total			-96.4206	(252)
Total energy cost			476.1311	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.4779	(257)
SAP value		76.0432	
SAP rating (Section 12)		76	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	609.6215	0.1582	96.4515	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			455.9961	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-496.1227	0.1324	-65.7077	
PV Unit electricity exported	-261.3588	0.1228	-32.1075	
Total			-97.8152	(269)
Total CO2, kg/year			403.2039	(272)
CO2 emissions per m2			5.6800	(273)
EI value			95.3415	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
Heatloss Floor 1			70.9800	0.1200	8.5176	75.0000	5323.5000	(28b)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			93.7900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.6517			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 13756.1700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	193.8035 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E20 Exposed floor (normal)	8.4500	0.3200	2.7040
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P7 Party Wall - Exposed floor (normal)	25.2500	0.1600	4.0400

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.0185 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	32.6702 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3659	16.3659	16.0392	15.0589	14.8955	14.2420	13.9153	13.9153	14.5688	15.3857	15.7124	15.5490	(38)
Heat transfer coeff	49.0361	49.0361	48.7094	47.7291	47.5657	46.9122	46.5855	46.5855	47.2390	48.0559	48.3826	48.2192	(39)
Average = Sum(39)m / 12 =												47.8380	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6908	0.6908	0.6862	0.6724	0.6701	0.6609	0.6563	0.6563	0.6655	0.6770	0.6816	0.6793	(40)
HLP (average)												0.6740	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.2697 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)
Average daily hot water use (litres/day)												138.3203	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
									Total per year (kWh/year) = Sum(64)m =			2544.5466	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(75)

Solar gains	42.7730	92.6022	174.0550	301.5827	403.2921	419.0362	396.3745	305.8819	210.3213	112.3593	55.2465	35.7661	(83)
Total gains	589.1195	636.8057	701.3971	796.6307	867.1157	854.2796	814.4731	727.1958	647.6393	578.5722	556.7443	568.1110	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	77.9254	77.9254	78.4481	80.0593	80.3343	81.4534	82.0247	82.0247	80.8899	79.5149	78.9779	79.2455	
alpha	6.1950	6.1950	6.2299	6.3373	6.3556	6.4302	6.4683	6.4683	6.3927	6.3010	6.2652	6.2830	
util living area	0.9637	0.9440	0.8889	0.7411	0.5584	0.4273	0.3487	0.3966	0.5889	0.8342	0.9387	0.9696	(86)
MIT	20.4464	20.5548	20.7407	20.9284	20.9882	20.9981	20.9996	20.9991	20.9877	20.8761	20.6432	20.4190	(87)
Th 2	20.3489	20.3489	20.3530	20.3652	20.3673	20.3755	20.3796	20.3796	20.3714	20.3612	20.3571	20.3591	(88)
util rest of house	0.9570	0.9343	0.8719	0.7132	0.5258	0.3934	0.3133	0.3571	0.5466	0.8054	0.9265	0.9639	(89)
MIT 2	19.7120	19.8451	20.0718	20.2945	20.3571	20.3741	20.3793	20.3790	20.3618	20.2392	19.9632	19.6864	(90)
Living area fraction									fLA = Living area / (4) =			0.4060	(91)
MIT	20.0102	20.1333	20.3434	20.5519	20.6133	20.6275	20.6312	20.6308	20.6159	20.4978	20.2393	19.9839	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0102	20.1333	20.3434	20.5519	20.6133	20.6275	20.6312	20.6308	20.6159	20.4978	20.2393	19.9839	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9530	0.9307	0.8716	0.7216	0.5386	0.4071	0.3276	0.3731	0.5632	0.8119	0.9240	0.9600	(94)
Useful gains	561.4353	592.6636	611.3646	574.8102	467.0045	347.7937	266.8569	271.3379	364.7766	469.7390	514.4381	545.3992	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	789.9805	776.4030	718.1423	603.8631	471.5351	348.4404	266.9890	271.6295	369.2166	518.8978	659.9065	785.1955	(97)
Space heating kWh	170.0377	123.4729	79.4426	20.9181	3.3708	0.0000	0.0000	0.0000	0.0000	36.5742	104.7373	178.4085	(98a)
Space heating requirement - total per year (kWh/year)												716.9620	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	170.0377	123.4729	79.4426	20.9181	3.3708	0.0000	0.0000	0.0000	0.0000	36.5742	104.7373	178.4085	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												716.9620	
Space heating per m2											(98c) / (4) =	10.1009	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	170.0377	123.4729	79.4426	20.9181	3.3708	0.0000	0.0000	0.0000	0.0000	36.5742	104.7373	178.4085	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													

	170.0377	123.4729	79.4426	20.9181	3.3708	0.0000	0.0000	0.0000	0.0000	36.5742	104.7373	178.4085 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972 (231)
Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-15.5048	-26.2822	-44.2693	-57.3694	-66.3987	-62.5005	-62.0252	-54.7629	-44.4553	-31.6868	-18.3490	-13.3304 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.6691	-6.9475	-16.9683	-31.6787	-44.4896	-44.1582	-44.2385	-34.3187	-23.1566	-11.1058	-3.9755	-2.1042 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	716.9620 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2544.5466 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	154.2094 (230a)
Total electricity for the above, kWh/year	154.2094 (231)
Electricity for lighting (calculated in Appendix L)	163.7369 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-762.7453 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2816.7097 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	716.9620	25.1600	180.3876	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	25.1600	640.2079	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	25.1600	38.7991	(249)
Energy for lighting	163.7369	25.1600	41.1962	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-496.9346	25.1600	-125.0287	
PV Unit electricity exported	-265.8108	5.8100	-15.4436	
Total			-140.4723	(252)
Total energy cost			760.1185	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	716.9620	0.1575	112.9328	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			472.4773	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-496.9346	0.1321	-65.6689	
PV Unit electricity exported	-265.8108	0.1223	-32.5072	
Total			-98.1761	(269)
Total CO2, kg/year			419.3243	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	716.9620	1.5831	1135.0312	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	1.5225	3874.0629	(278)
Space and water heating			5009.0941	(279)

Pumps, fans and electric keep-hot	154.2094	1.5128	233.2880 (281)
Energy for lighting	163.7369	1.5338	251.1452 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-496.9346	1.4883	-739.5718
PV Unit electricity exported	-265.8108	0.4488	-119.2938
Total			-858.8656 (283)
Total Primary energy kWh/year			4634.6617 (286)

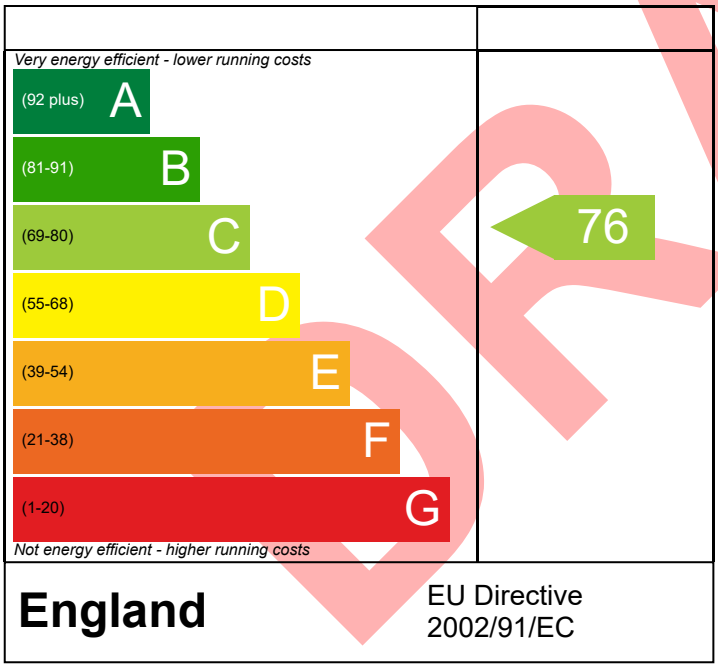
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	70.98 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

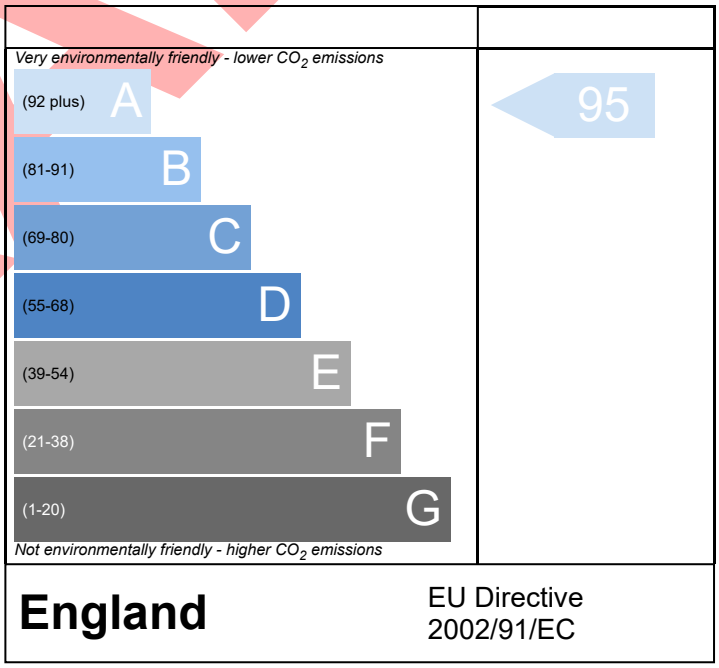
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:52

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	66 m^2
Site Reference	Unit 289 L01 _Copy	Plot Reference	Unit 289 L01_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*13.7 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	6.74 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*73.96 kWh$_{PE}$/m^2*	
Dwelling primary energy	73.64 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*33.2 kWh/m^2*	
Dwelling fabric energy efficiency	32.0 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.12	Heatloss Floor 1 (0.12)	OK
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	25.12	0.14 **(!)**
Party wall: Party Wall (1)	55.02	0 **(!)**
Party wall: Party Wall (2)	3.85	0 **(!)**
Upper floor: Heatloss Floor 1, Heatloss Floor 1	66.41	0.12

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SE, Opening Type 1	11.81	South East	0.83	1.3
NE, Opening Type 1	7.88	North East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E20: Exposed floor (normal)	Calculated by person with suitable expertise	0.32	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P7: Exposed floor (normal)	Calculated by person with suitable expertise	0.16	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.86 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 289 L01 _Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 289 L01_Copy	**Prop Type Ref**	Unit 289 L01
Property			

SAP Rating	73 C	**DER**	6.74	**TER**	13.70
Environmental	95 A	**% DER < TER**			50.80
CO_2 Emissions (t/year)	0.46	**DFEE**	32.05	**TFEE**	33.19
Compliance Check	See BREL	**% DFEE < TFEE**			3.45
% DPER < TPER	0.43	**DPER**	73.64	**TPER**	73.96

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.4100 (1b)	x	2.4000 (2b)	=	159.3840	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.4100					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.3840	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
Heatloss Floor 1			66.4100	0.1200	7.9692	75.0000	4980.7500	(28b)
External Wall 1	44.8100	19.6900	25.1200	0.1400	3.5168	14.0000	351.6800	(29a)
Total net area of external elements Aum(A, m2)			111.2200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.8177			(33)
Party Wall 1			55.0200	0.0000	0.0000	20.0000	1100.4000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Ceiling 1			66.4100			80.0000	5312.8000	(32b)
Internal Wall 1			140.4500			9.0000	1264.0500	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 13086.6800	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	197.0589	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240

E4 Jamb	23.2000	0.0500	1.1600	
E20 Exposed floor (normal)	16.5900	0.3200	5.3088	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P7 Party Wall - Exposed floor (normal)	21.8000	0.1600	3.4880	
E16 Corner (normal)	5.4000	0.0900	0.4860	
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				11.1908 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	47.0085 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.9138	15.7461	15.5785	14.7402	14.5726	13.7343	13.7343	13.5667	14.0696	14.5726	14.9079	15.2432	(38)
Heat transfer coeff	62.9223	62.7547	62.5870	61.7488	61.5811	60.7429	60.7429	60.5752	61.0782	61.5811	61.9164	62.2517	(39)
Average = Sum(39)m / 12 =												61.7069	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9475	0.9450	0.9424	0.9298	0.9273	0.9147	0.9147	0.9121	0.9197	0.9273	0.9323	0.9374	(40)
HLP (average)												0.9292	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.1559	(42)
Hot water usage for mixer showers	83.0050	81.7576	79.9399	76.4620	73.8955	71.0332	69.4063	71.2103	73.1878	76.2609	79.8135	82.6870	(42a)
Hot water usage for baths	26.0831	25.6958	25.1503	24.1445	23.3913	22.5562	22.1051	22.6468	23.2366	24.1302	25.1567	25.9950	(42b)
Hot water usage for other uses	36.7088	35.3739	34.0390	32.7042	31.3693	30.0344	30.0344	31.3693	32.7042	34.0390	35.3739	36.7088	(42c)
Average daily hot water use (litres/day)												134.0826	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7969	142.8273	139.1292	133.3107	128.6561	123.6239	121.5459	125.2264	129.1285	134.4302	140.3441	145.3907	(44)
Energy conte	230.9067	203.3841	213.8364	182.4956	173.1958	152.0100	146.9993	155.0565	159.2284	182.4205	199.9459	227.6467	(45)
Energy content (annual)											Total = Sum(45)m =	2227.1258	
Distribution loss (46)m = 0.15 x (45)m	34.6360	30.5076	32.0755	27.3743	25.9794	22.8015	22.0499	23.2585	23.8843	27.3631	29.9919	34.1470	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
										Total per year (kWh/year) = Sum(64)m =		2474.1578	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	93.5611	82.7855	87.8852	76.9230	74.3722	66.7865	65.6619	68.3409	69.1866	77.4394	82.7252	92.4772	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7302	19.3006	15.6963	11.8831	8.8827	7.4992	8.1031	10.5328	14.1371	17.9502	20.9506	22.3341	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.7577	284.6815	277.3137	261.6285	241.8288	223.2199	210.7880	207.8643	215.2321	230.9172	250.7169	269.3258	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	(71)
Water heating gains (Table 5)	125.7542	123.1928	118.1253	106.8375	99.9627	92.7591	88.2552	91.8561	96.0926	104.0853	114.8961	124.2973	(72)
Total internal gains	522.4518	520.3846	504.3451	473.5589	443.8841	416.6880	400.3562	403.4629	418.6715	446.1625	479.7734	509.1670	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(75)
Southeast	11.8100	36.7938	0.6300	0.8270	0.7700	156.8932	(77)

Solar gains	188.9949	332.5911	483.3882	646.4144	767.3690	780.8797	744.9195	651.7680	539.3863	375.2206	228.3142	160.4838	(83)
Total gains	711.4468	852.9757	987.7333	1119.9732	1211.2531	1197.5676	1145.2757	1055.2309	958.0577	821.3831	708.0876	669.6508	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.7726	57.9270	58.0821	58.8706	59.0309	59.8455	59.8455	60.0112	59.5170	59.0309	58.7112	58.3950	
alpha	4.8515	4.8618	4.8721	4.9247	4.9354	4.9897	4.9897	5.0007	4.9678	4.9354	4.9141	4.8930	
util living area	0.9458	0.8913	0.7928	0.6338	0.4666	0.3238	0.2332	0.2638	0.4357	0.7145	0.9007	0.9562	(86)
MIT	20.2333	20.4924	20.7472	20.9241	20.9846	20.9980	20.9997	20.9995	20.9918	20.8909	20.5464	20.1755	(87)
Th 2	20.1273	20.1295	20.1316	20.1422	20.1444	20.1551	20.1551	20.1572	20.1508	20.1444	20.1401	20.1358	(88)
util rest of house	0.9351	0.8729	0.7638	0.5961	0.4255	0.2814	0.1885	0.2156	0.3837	0.6703	0.8805	0.9473	(89)
MIT 2	19.2666	19.5795	19.8743	20.0727	20.1323	20.1539	20.1549	20.1570	20.1455	20.0472	19.6596	19.2026	(90)
Living area fraction										fLA = Living area / (4) =		0.3439	(91)
MIT	19.5991	19.8935	20.1745	20.3655	20.4254	20.4442	20.4455	20.4467	20.4366	20.3374	19.9646	19.5372	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5991	19.8935	20.1745	20.3655	20.4254	20.4442	20.4455	20.4467	20.4366	20.3374	19.9646	19.5372	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9275	0.8674	0.7653	0.6061	0.4391	0.2959	0.2039	0.2322	0.4013	0.6807	0.8758	0.9399	(94)
Useful gains	659.8398	739.8595	755.9399	678.8452	531.8655	354.4158	233.5186	245.0041	384.4595	559.1230	620.1594	629.4226	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	962.6555	940.9113	855.8483	707.9826	537.3221	354.9951	233.5853	245.1313	387.0263	599.6389	796.5286	954.7690	(97)
Space heating kWh	225.2949	135.1068	74.3318	20.9790	4.0597	0.0000	0.0000	0.0000	0.0000	30.1438	126.9858	242.0577	(98a)
Space heating requirement - total per year (kWh/year)												858.9596	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	225.2949	135.1068	74.3318	20.9790	4.0597	0.0000	0.0000	0.0000	0.0000	30.1438	126.9858	242.0577	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												858.9596	
Space heating per m2											(98c) / (4) =	12.9342	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	225.2949	135.1068	74.3318	20.9790	4.0597	0.0000	0.0000	0.0000	0.0000	30.1438	126.9858	242.0577	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	225.2949	135.1068	74.3318	20.9790	4.0597	0.0000	0.0000	0.0000	0.0000	30.1438	126.9858	242.0577	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5604	10.4416	11.5604	11.1874	11.5604	11.1874	11.5604	11.5604	11.1874	11.5604	11.1874	11.5604	(231)
Lighting	19.0203	15.2588	13.7389	10.0657	7.7750	6.3523	7.0926	9.2193	11.9749	15.7117	17.7464	19.5489	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.1761	-25.7263	-41.5390	-51.7446	-60.3674	-57.9694	-57.0463	-51.4863	-42.0498	-30.9923	-18.6076	-13.6302	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.7789	-6.7684	-15.7245	-27.1787	-38.5772	-39.7876	-39.2248	-31.7520	-21.6853	-11.1066	-4.0551	-2.1060	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1	858.9596	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2474.1578	(219)
Space cooling fuel	0.0000	(221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)

mechanical ventilation fans (SFP = 0.7000)	136.1139	(230a)
Total electricity for the above, kWh/year	136.1139	(231)
Electricity for lighting (calculated in Appendix L)	153.5048	(232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	-708.0805	(233)
Wind generation	0.0000	(234)

Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2914.6557	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	858.9596	16.4900	141.6424	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	16.4900	407.9886	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	136.1139	16.4900	22.4452	(249)
Energy for lighting	153.5048	16.4900	25.3129	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-467.3353	16.4900	-77.0636	
PV Unit electricity exported	-240.7452	5.5900	-13.4577	
Total			-90.5212	(252)
Total energy cost			506.8679	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.6378	(257)
SAP value		73.4505	
SAP rating (Section 12)		73	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	858.9596	0.1583	135.9786	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2474.1578	0.1413	349.5790	(264)
Space and water heating			485.5577	(265)
Pumps, fans and electric keep-hot	136.1139	0.1387	18.8807	(267)
Energy for lighting	153.5048	0.1443	22.1555	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-467.3353	0.1325	-61.9078	
PV Unit electricity exported	-240.7452	0.1226	-29.5146	
Total			-91.4224	(269)
Total CO2, kg/year			435.1714	(272)
CO2 emissions per m2			6.5500	(273)
EI value			94.7659	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.4100	(1b)	x 2.4000	(2b) =	159.3840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.4100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		159.3840	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
Heatloss Floor 1			66.4100	0.1200	7.9692	75.0000	4980.7500	(28b)
External Wall 1	44.8100	19.6900	25.1200	0.1400	3.5168	14.0000	351.6800	(29a)
Total net area of external elements Aum(A, m2)			111.2200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.8177			(33)
Party Wall 1			55.0200	0.0000	0.0000	20.0000	1100.4000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Ceiling 1			66.4100			80.0000	5312.8000	(32b)
Internal Wall 1			140.4500			9.0000	1264.0500	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13086.6800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 197.0589 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E20 Exposed floor (normal)	16.5900	0.3200	5.3088
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P7 Party Wall - Exposed floor (normal)	21.8000	0.1600	3.4880
E16 Corner (normal)	5.4000	0.0900	0.4860
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.1908 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 47.0085 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.0814	16.0814	15.7461	14.7402	14.5726	13.9020	13.5667	13.5667	14.2373	15.0755	15.4108	15.2432	(38)
Heat transfer coeff	63.0900	63.0900	62.7547	61.7488	61.5811	60.9105	60.5752	60.5752	61.2458	62.0841	62.4194	62.2517	(39)

Average = Sum(39)m / 12 = 61.8605

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9500	0.9500	0.9450	0.9298	0.9273	0.9172	0.9121	0.9121	0.9222	0.9349	0.9399	0.9374	(40)
HLP (average)												0.9315	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1559 (42)
Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
83.0050	81.7576	79.9399	76.4620	73.8955	71.0332	69.4063	71.2103	73.1878	76.2609	79.8135	82.6870	(42a)

Hot water usage for baths

26.0831	25.6958	25.1503	24.1445	23.3913	22.5562	22.1051	22.6468	23.2366	24.1302	25.1567	25.9950	(42b)

Hot water usage for other uses

36.7088	35.3739	34.0390	32.7042	31.3693	30.0344	30.0344	31.3693	32.7042	34.0390	35.3739	36.7088	(42c)

Average daily hot water use (litres/day) 134.0826 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7969	142.8273	139.1292	133.3107	128.6561	123.6239	121.5459	125.2264	129.1285	134.4302	140.3441	145.3907	(44)
Energy conte	230.9067	203.3841	213.8364	182.4956	173.1958	152.0100	146.9993	155.0565	159.2284	182.4205	199.9459	227.6467	(45)
Energy content (annual)										Total = Sum(45)m =		2227.1258	
Distribution loss (46)m = 0.15 x (45)m	34.6360	30.5076	32.0755	27.3743	25.9794	22.8015	22.0499	23.2585	23.8843	27.3631	29.9919	34.1470	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
									Total per year (kWh/year) = Sum(64)m =		2474.1578	(64)
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

93.5611	82.7855	87.8852	76.9230	74.3722	66.7865	65.6619	68.3409	69.1866	77.4394	82.7252	92.4772	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	21.7302	19.3006	15.6963	11.8831	8.8827	7.4992	8.1031	10.5328	14.1371	17.9502	20.9506	22.3341	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	281.7577	284.6815	277.3137	261.6285	241.8288	223.2199	210.7880	207.8643	215.2321	230.9172	250.7169	269.3258	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	(71)

Water heating gains (Table 5)

	125.7542	123.1928	118.1253	106.8375	99.9627	92.7591	88.2552	91.8561	96.0926	104.0853	114.8961	124.2973	(72)

Total internal gains

	522.4518	520.3846	504.3451	473.5589	443.8841	416.6880	400.3562	403.4629	418.6715	446.1625	479.7734	509.1670	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(75)
Southeast	11.8100	33.4622	0.6300	0.8270	0.7700	142.6869	(77)

Solar gains	171.2264	321.1940	487.0707	684.6820	805.1181	796.7968	769.3033	653.9832	538.3810	359.9515	212.5016	148.7415	(83)
Total gains	693.6782	841.5786	991.4157	1158.2409	1249.0022	1213.4847	1169.6595	1057.4461	957.0525	806.1140	692.2750	657.9085	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.6191	57.6191	57.9270	58.8706	59.0309	59.6808	60.0112	60.0112	59.3541	58.5527	58.2381	58.3950	
alpha	4.8413	4.8413	4.8618	4.9247	4.9354	4.9787	5.0007	5.0007	4.9569	4.9035	4.8825	4.8930	
util living area	0.9545	0.9072	0.8186	0.6576	0.4989	0.3893	0.3152	0.3539	0.5143	0.7682	0.9182	0.9631	(86)
MIT	20.1551	20.4118	20.6858	20.9037	20.9771	20.9944	20.9984	20.9972	20.9796	20.8326	20.4651	20.0986	(87)
Th 2	20.1252	20.1252	20.1295	20.1422	20.1444	20.1529	20.1572	20.1572	20.1486	20.1380	20.1337	20.1358	(88)
util rest of house	0.9454	0.8912	0.7929	0.6225	0.4599	0.3478	0.2720	0.3063	0.4643	0.7293	0.9010	0.9556	(89)
MIT 2	19.1682	19.4791	19.8021	20.0510	20.1255	20.1491	20.1563	20.1556	20.1336	19.9809	19.5574	19.1066	(90)
Living area fraction									fLA = Living area / (4) =			0.3439	(91)
MIT	19.5076	19.7999	20.1060	20.3443	20.4184	20.4398	20.4459	20.4450	20.4246	20.2738	19.8696	19.4478	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5076	19.7999	20.1060	20.3443	20.4184	20.4398	20.4459	20.4450	20.4246	20.2738	19.8696	19.4478	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9377	0.8846	0.7922	0.6310	0.4725	0.3619	0.2868	0.3226	0.4807	0.7357	0.8951	0.9483	(94)
Useful gains	650.4957	744.4472	785.3861	730.8304	590.1065	439.1590	335.4762	341.1309	460.0579	593.0901	619.6372	623.9271	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	984.6832	977.8860	910.3215	768.4191	598.4689	440.9811	335.9440	341.9493	466.9749	656.4674	828.2793	980.3248	(97)
Space heating kWh	248.6355	156.8709	92.9520	27.0639	6.2216	0.0000	0.0000	0.0000	0.0000	47.1527	150.2223	265.1599	(98a)
Space heating requirement - total per year (kWh/year)												994.2788	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	248.6355	156.8709	92.9520	27.0639	6.2216	0.0000	0.0000	0.0000	0.0000	47.1527	150.2223	265.1599	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												994.2788	
Space heating per m2											(98c) / (4) =	14.9718	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	248.6355	156.8709	92.9520	27.0639	6.2216	0.0000	0.0000	0.0000	0.0000	47.1527	150.2223	265.1599	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	248.6355	156.8709	92.9520	27.0639	6.2216	0.0000	0.0000	0.0000	0.0000	47.1527	150.2223	265.1599	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
Efficiency of water heater												100.0000	(216)

(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5604	10.4416	11.5604	11.1874	11.5604	11.1874	11.5604	11.5604	11.1874	11.5604	11.1874	11.5604	(231)
Lighting	19.0203	15.2588	13.7389	10.0657	7.7750	6.3523	7.0926	9.2193	11.9749	15.7117	17.7464	19.5489	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.6585	-24.8273	-41.7496	-54.1037	-62.5789	-58.8113	-58.3661	-51.5020	-41.7727	-29.8488	-17.3402	-12.6023	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.3302	-6.2352	-15.4943	-29.1369	-41.0776	-40.8915	-40.9673	-31.7699	-21.4298	-10.1530	-3.5283	-1.8258	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	994.2788	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2474.1578	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.1139	(230a)
Total electricity for the above, kWh/year	136.1139	(231)
Electricity for lighting (calculated in Appendix L)	153.5048	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-713.0011	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3045.0543	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	994.2788	25.1600	250.1606	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	25.1600	622.4981	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	136.1139	25.1600	34.2463	(249)
Energy for lighting	153.5048	25.1600	38.6218	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-468.1613	25.1600	-117.7894	
PV Unit electricity exported	-244.8397	5.8100	-14.2252	
Total			-132.0146	(252)
Total energy cost			813.5121	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	994.2788	0.1578	156.8574	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2474.1578	0.1413	349.5790	(264)
Space and water heating			506.4364	(265)
Pumps, fans and electric keep-hot	136.1139	0.1387	18.8807	(267)
Energy for lighting	153.5048	0.1443	22.1555	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-468.1613	0.1322	-61.8791	
PV Unit electricity exported	-244.8397	0.1220	-29.8823	
Total			-91.7614	(269)
Total CO2, kg/year			455.7112	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	994.2788	1.5840	1574.8980	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	1.5225	3766.8228	(278)
Space and water heating			5341.7207	(279)
Pumps, fans and electric keep-hot	136.1139	1.5128	205.9132	(281)
Energy for lighting	153.5048	1.5338	235.4508	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-468.1613	1.4884	-696.7965	
PV Unit electricity exported	-244.8397	0.4479	-109.6588	
Total			-806.4554	(283)
Total Primary energy kWh/year			4976.6294	(286)

SAP 10 EPC IMPROVEMENTS

Unit 289 L01_Copy

Current energy efficiency rating: C 73
Current environmental impact rating: A 95

N Solar water heating	Not applicable
U Solar photovoltaic panels	Not applicable
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 73
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£946	£946	£0
Space heating	£284	£284	£0
Water heating	£622	£622	£0
Lighting	£39	£39	£0
Generated (PV)	-£132	-£132	£0
Total cost of fuels	£814	£814	£0
Total cost of uses	£813	£813	£0
Delivered energy	46 kWh/m²	46 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.5 tonnes	0.0 tonnes
CO2 emissions per m²	7 kg/m²	7 kg/m²	0 kg/m²
Primary energy	75 kWh/m²	75 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.4100 (1b)	x	2.4000 (2b)	=	159.3840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.4100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.3840	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
Heatloss Floor 1			66.4100	0.1200	7.9692	75.0000	4980.7500	(28b)
External Wall 1	44.8100	19.6900	25.1200	0.1400	3.5168	14.0000	351.6800	(29a)
Total net area of external elements Aum(A, m2)			111.2200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.8177			(33)
Party Wall 1			55.0200	0.0000	0.0000	20.0000	1100.4000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Ceiling 1			66.4100			80.0000	5312.8000	(32b)
Internal Wall 1			140.4500			9.0000	1264.0500	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13086.6800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 197.0589 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E20 Exposed floor (normal)	16.5900	0.3200	5.3088
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P7 Party Wall - Exposed floor (normal)	21.8000	0.1600	3.4880
E16 Corner (normal)	5.4000	0.0900	0.4860
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.1908 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 47.0085 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.9138	15.7461	15.5785	14.7402	14.5726	13.7343	13.7343	13.5667	14.0696	14.5726	14.9079	15.2432	(38)
Heat transfer coeff	62.9223	62.7547	62.5870	61.7488	61.5811	60.7429	60.7429	60.5752	61.0782	61.5811	61.9164	62.2517	(39)
Average = Sum(39)m / 12 =												61.7069	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9475	0.9450	0.9424	0.9298	0.9273	0.9147	0.9147	0.9121	0.9197	0.9273	0.9323	0.9374	(40)
HLP (average)												0.9292	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1559 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	83.0050	81.7576	79.9399	76.4620	73.8955	71.0332	69.4063	71.2103	73.1878	76.2609	79.8135	82.6870	(42a)
Hot water usage for baths	26.0831	25.6958	25.1503	24.1445	23.3913	22.5562	22.1051	22.6468	23.2366	24.1302	25.1567	25.9950	(42b)
Hot water usage for other uses	36.7088	35.3739	34.0390	32.7042	31.3693	30.0344	30.0344	31.3693	32.7042	34.0390	35.3739	36.7088	(42c)
Average daily hot water use (litres/day)												134.0826	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7969	142.8273	139.1292	133.3107	128.6561	123.6239	121.5459	125.2264	129.1285	134.4302	140.3441	145.3907	(44)
Energy conte	230.9067	203.3841	213.8364	182.4956	173.1958	152.0100	146.9993	155.0565	159.2284	182.4205	199.9459	227.6467	(45)
Energy content (annual)										Total = Sum(45)m =		2227.1258	
Distribution loss (46)m = 0.15 x (45)m	34.6360	30.5076	32.0755	27.3743	25.9794	22.8015	22.0499	23.2585	23.8843	27.3631	29.9919	34.1470	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
									Total per year (kWh/year) = Sum(64)m =			2474.1578	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	93.5611	82.7855	87.8852	76.9230	74.3722	66.7865	65.6619	68.3409	69.1866	77.4394	82.7252	92.4772	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7302	19.3006	15.6963	11.8831	8.8827	7.4992	8.1031	10.5328	14.1371	17.9502	20.9506	22.3341	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.7577	284.6815	277.3137	261.6285	241.8288	223.2199	210.7880	207.8643	215.2321	230.9172	250.7169	269.3258	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	(71)
Water heating gains (Table 5)													

	125.7542	123.1928	118.1253	106.8375	99.9627	92.7591	88.2552	91.8561	96.0926	104.0853	114.8961	124.2973	(72)
Total internal gains													
	522.4518	520.3846	504.3451	473.5589	443.8841	416.6880	400.3562	403.4629	418.6715	446.1625	479.7734	509.1670	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(75)
Southeast	11.8100	36.7938	0.6300	0.8270	0.7700	156.8932	(77)

Solar gains	188.9949	332.5911	483.3882	646.4144	767.3690	780.8797	744.9195	651.7680	539.3863	375.2206	228.3142	160.4838	(83)
Total gains	711.4468	852.9757	987.7333	1119.9732	1211.2531	1197.5676	1145.2757	1055.2309	958.0577	821.3831	708.0876	669.6508	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.7726	57.9270	58.0821	58.8706	59.0309	59.8455	59.8455	60.0112	59.5170	59.0309	58.7112	58.3950	
alpha	4.8515	4.8618	4.8721	4.9247	4.9354	4.9897	4.9897	5.0007	4.9678	4.9354	4.9141	4.8930	
util living area													
	0.9458	0.8913	0.7928	0.6338	0.4666	0.3238	0.2332	0.2638	0.4357	0.7145	0.9007	0.9562	(86)
MIT	20.2333	20.4924	20.7472	20.9241	20.9846	20.9980	20.9997	20.9995	20.9918	20.8909	20.5464	20.1755	(87)
Th 2	20.1273	20.1295	20.1316	20.1422	20.1444	20.1551	20.1551	20.1572	20.1508	20.1444	20.1401	20.1358	(88)
util rest of house													
	0.9351	0.8729	0.7638	0.5961	0.4255	0.2814	0.1885	0.2156	0.3837	0.6703	0.8805	0.9473	(89)
MIT 2	19.2666	19.5795	19.8743	20.0727	20.1323	20.1539	20.1549	20.1570	20.1455	20.0472	19.6596	19.2026	(90)
Living area fraction										fLA = Living area / (4) =		0.3439	(91)
MIT	19.5991	19.8935	20.1745	20.3655	20.4254	20.4442	20.4455	20.4467	20.4366	20.3374	19.9646	19.5372	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5991	19.8935	20.1745	20.3655	20.4254	20.4442	20.4455	20.4467	20.4366	20.3374	19.9646	19.5372	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9275	0.8674	0.7653	0.6061	0.4391	0.2959	0.2039	0.2322	0.4013	0.6807	0.8758	0.9399	(94)
Useful gains	659.8398	739.8595	755.9399	678.8452	531.8655	354.4158	233.5186	245.0041	384.4595	559.1230	620.1594	629.4226	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	962.6555	940.9113	855.8483	707.9826	537.3221	354.9951	233.5853	245.1313	387.0263	599.6389	796.5286	954.7690	(97)
Space heating kWh													
	225.2949	135.1068	74.3318	20.9790	4.0597	0.0000	0.0000	0.0000	0.0000	30.1438	126.9858	242.0577	(98a)
Space heating requirement - total per year (kWh/year)												858.9596	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	225.2949	135.1068	74.3318	20.9790	4.0597	0.0000	0.0000	0.0000	0.0000	30.1438	126.9858	242.0577	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												858.9596	
Space heating per m2											(98c) / (4) =	12.9342	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	225.2949	135.1068	74.3318	20.9790	4.0597	0.0000	0.0000	0.0000	0.0000	30.1438	126.9858	242.0577	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	225.2949	135.1068	74.3318	20.9790	4.0597	0.0000	0.0000	0.0000	0.0000	30.1438	126.9858	242.0577	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5604	10.4416	11.5604	11.1874	11.5604	11.1874	11.5604	11.5604	11.1874	11.5604	11.1874	11.5604	(231)
Lighting	19.0203	15.2588	13.7389	10.0657	7.7750	6.3523	7.0926	9.2193	11.9749	15.7117	17.7464	19.5489	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.1761	-25.7263	-41.5390	-51.7446	-60.3674	-57.9694	-57.0463	-51.4863	-42.0498	-30.9923	-18.6076	-13.6302	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													

(233b)m	-2.7789	-6.7684	-15.7245	-27.1787	-38.5772	-39.7876	-39.2248	-31.7520	-21.6853	-11.1066	-4.0551	-2.1060	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	858.9596	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2474.1578	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.1139	(230a)
Total electricity for the above, kWh/year	136.1139	(231)
Electricity for lighting (calculated in Appendix L)	153.5048	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-708.0805	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2914.6557	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	858.9596	16.4900	141.6424	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	16.4900	407.9886	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	136.1139	16.4900	22.4452	(249)
Energy for lighting	153.5048	16.4900	25.3129	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-467.3353	16.4900	-77.0636	
PV Unit electricity exported	-240.7452	5.5900	-13.4577	
Total			-90.5212	(252)
Total energy cost			506.8679	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.6378	(257)
SAP value		73.4505	
SAP rating (Section 12)		73	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	858.9596	0.1583	135.9786	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2474.1578	0.1413	349.5790	(264)
Space and water heating			485.5577	(265)
Pumps, fans and electric keep-hot	136.1139	0.1387	18.8807	(267)
Energy for lighting	153.5048	0.1443	22.1555	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-467.3353	0.1325	-61.9078	
PV Unit electricity exported	-240.7452	0.1226	-29.5146	
Total			-91.4224	(269)
Total CO2, kg/year			435.1714	(272)
CO2 emissions per m2			6.5500	(273)
EI value			94.7659	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		66.4100 (1b)	x	2.4000 (2b)	=	159.3840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.4100						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.3840	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
Heatloss Floor 1			66.4100	0.1200	7.9692	75.0000	4980.7500	(28b)
External Wall 1	44.8100	19.6900	25.1200	0.1400	3.5168	14.0000	351.6800	(29a)
Total net area of external elements Aum(A, m2)			111.2200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.8177			(33)
Party Wall 1			55.0200	0.0000	0.0000	20.0000	1100.4000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Ceiling 1			66.4100			80.0000	5312.8000	(32b)
Internal Wall 1			140.4500			9.0000	1264.0500	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13086.6800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		197.0589 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E20 Exposed floor (normal)	16.5900	0.3200	5.3088
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P7 Party Wall - Exposed floor (normal)	21.8000	0.1600	3.4880
E16 Corner (normal)	5.4000	0.0900	0.4860
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		11.1908 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	47.0085 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.0814	16.0814	15.7461	14.7402	14.5726	13.9020	13.5667	13.5667	14.2373	15.0755	15.4108	15.2432	(38)
Heat transfer coeff	63.0900	63.0900	62.7547	61.7488	61.5811	60.9105	60.5752	60.5752	61.2458	62.0841	62.4194	62.2517	(39)
Average = Sum(39)m / 12 =												61.8605	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9500	0.9500	0.9450	0.9298	0.9273	0.9172	0.9121	0.9121	0.9222	0.9349	0.9399	0.9374	(40)
HLP (average)												0.9315	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1559	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
83.0050	81.7576	79.9399	76.4620	73.8955	71.0332	69.4063	71.2103	73.1878	76.2609	79.8135	82.6870	(42a)

Hot water usage for baths

26.0831	25.6958	25.1503	24.1445	23.3913	22.5562	22.1051	22.6468	23.2366	24.1302	25.1567	25.9950	(42b)

Hot water usage for other uses

36.7088	35.3739	34.0390	32.7042	31.3693	30.0344	30.0344	31.3693	32.7042	34.0390	35.3739	36.7088	(42c)

Average daily hot water use (litres/day)	134.0826	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7969	142.8273	139.1292	133.3107	128.6561	123.6239	121.5459	125.2264	129.1285	134.4302	140.3441	145.3907	(44)
Energy conte	230.9067	203.3841	213.8364	182.4956	173.1958	152.0100	146.9993	155.0565	159.2284	182.4205	199.9459	227.6467	(45)
Energy content (annual)										Total = Sum(45)m =		2227.1258	
Distribution loss (46)m = 0.15 x (45)m	34.6360	30.5076	32.0755	27.3743	25.9794	22.8015	22.0499	23.2585	23.8843	27.3631	29.9919	34.1470	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)

Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss
20.9808 18.9504 20.9808 20.3040 20.9808 20.3040 20.9808 20.9808 20.3040 20.9808 20.3040 20.9808 (56)
If cylinder contains dedicated solar storage
20.9808 18.9504 20.9808 20.3040 20.9808 20.3040 20.9808 20.9808 20.3040 20.9808 20.3040 20.9808 (57)
Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)
Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)
Total heat required for water heating calculated for each month
251.8875 222.3345 234.8172 202.7996 194.1766 172.3140 167.9801 176.0373 179.5324 203.4013 220.2499 248.6275 (62)
WWHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63a)
PV diverter -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 (63b)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63c)
FGHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)
Output from w/h
251.8875 222.3345 234.8172 202.7996 194.1766 172.3140 167.9801 176.0373 179.5324 203.4013 220.2499 248.6275 (64)
Total per year (kWh/year) = Sum(64)m = 2474.1578 (64)
Electric shower(s)
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month
93.5611 82.7855 87.8852 76.9230 74.3722 66.7865 65.6619 68.3409 69.1866 77.4394 82.7252 92.4772 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
21.7302 19.3006 15.6963 11.8831 8.8827 7.4992 8.1031 10.5328 14.1371 17.9502 20.9506 22.3341 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
281.7577 284.6815 277.3137 261.6285 241.8288 223.2199 210.7880 207.8643 215.2321 230.9172 250.7169 269.3258 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
50.0914 50.0914 50.0914 50.0914 50.0914 50.0914 50.0914 50.0914 50.0914 50.0914 50.0914 50.0914 (69)
Pumps, fans 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-86.2367 -86.2367 -86.2367 -86.2367 -86.2367 -86.2367 -86.2367 -86.2367 -86.2367 -86.2367 -86.2367 -86.2367 (71)
Water heating gains (Table 5)
125.7542 123.1928 118.1253 106.8375 99.9627 92.7591 88.2552 91.8561 96.0926 104.0853 114.8961 124.2973 (72)
Total internal gains
522.4518 520.3846 504.3451 473.5589 443.8841 416.6880 400.3562 403.4629 418.6715 446.1625 479.7734 509.1670 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(75)
Southeast	11.8100	33.4622	0.6300	0.8270	0.7700	142.6869	(77)

Solar gains	171.2264	321.1940	487.0707	684.6820	805.1181	796.7968	769.3033	653.9832	538.3810	359.9515	212.5016	148.7415	(83)
Total gains	693.6782	841.5786	991.4157	1158.2409	1249.0022	1213.4847	1169.6595	1057.4461	957.0525	806.1140	692.2750	657.9085	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.6191	57.6191	57.9270	58.8706	59.0309	59.6808	60.0112	60.0112	59.3541	58.5527	58.2381	58.3950	
alpha	4.8413	4.8413	4.8618	4.9247	4.9354	4.9787	5.0007	5.0007	4.9569	4.9035	4.8825	4.8930	
util living area	0.9545	0.9072	0.8186	0.6576	0.4989	0.3893	0.3152	0.3539	0.5143	0.7682	0.9182	0.9631	(86)
MIT	20.1551	20.4118	20.6858	20.9037	20.9771	20.9944	20.9984	20.9972	20.9796	20.8326	20.4651	20.0986	(87)
Th 2	20.1252	20.1252	20.1295	20.1422	20.1444	20.1529	20.1572	20.1572	20.1486	20.1380	20.1337	20.1358	(88)
util rest of house	0.9454	0.8912	0.7929	0.6225	0.4599	0.3478	0.2720	0.3063	0.4643	0.7293	0.9010	0.9556	(89)
MIT 2	19.1682	19.4791	19.8021	20.0510	20.1255	20.1491	20.1563	20.1556	20.1336	19.9809	19.5574	19.1066	(90)
Living area fraction									fLA = Living area / (4) =			0.3439	(91)
MIT	19.5076	19.7999	20.1060	20.3443	20.4184	20.4398	20.4459	20.4450	20.4246	20.2738	19.8696	19.4478	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5076	19.7999	20.1060	20.3443	20.4184	20.4398	20.4459	20.4450	20.4246	20.2738	19.8696	19.4478	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9377	0.8846	0.7922	0.6310	0.4725	0.3619	0.2868	0.3226	0.4807	0.7357	0.8951	0.9483	(94)
Useful gains	650.4957	744.4472	785.3861	730.8304	590.1065	439.1590	335.4762	341.1309	460.0579	593.0901	619.6372	623.9271	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	984.6832	977.8860	910.3215	768.4191	598.4689	440.9811	335.9440	341.9493	466.9749	656.4674	828.2793	980.3248	(97)
Space heating kWh	248.6355	156.8709	92.9520	27.0639	6.2216	0.0000	0.0000	0.0000	0.0000	47.1527	150.2223	265.1599	(98a)

Space heating requirement - total per year (kWh/year) 994.2788
Solar heating kWh
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (98b)
Solar heating contribution - total per year (kWh/year) 0.0000
Space heating kWh
248.6355 156.8709 92.9520 27.0639 6.2216 0.0000 0.0000 0.0000 0.0000 47.1527 150.2223 265.1599 (98c)
Space heating requirement after solar contribution - total per year (kWh/year) 994.2788
Space heating per m2 (98c) / (4) = 14.9718 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	248.6355	156.8709	92.9520	27.0639	6.2216	0.0000	0.0000	0.0000	0.0000	47.1527	150.2223	265.1599	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	248.6355	156.8709	92.9520	27.0639	6.2216	0.0000	0.0000	0.0000	0.0000	47.1527	150.2223	265.1599	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5604	10.4416	11.5604	11.1874	11.5604	11.1874	11.5604	11.5604	11.1874	11.5604	11.1874	11.5604	(231)
Lighting	19.0203	15.2588	13.7389	10.0657	7.7750	6.3523	7.0926	9.2193	11.9749	15.7117	17.7464	19.5489	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.6585	-24.8273	-41.7496	-54.1037	-62.5789	-58.8113	-58.3661	-51.5020	-41.7727	-29.8488	-17.3402	-12.6023	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.3302	-6.2352	-15.4943	-29.1369	-41.0776	-40.8915	-40.9673	-31.7699	-21.4298	-10.1530	-3.5283	-1.8258	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												994.2788	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2474.1578	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)													
mechanical ventilation fans (SFP = 0.7000)												136.1139	(230a)
Total electricity for the above, kWh/year												136.1139	(231)
Electricity for lighting (calculated in Appendix L)												153.5048	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-713.0011	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3045.0543	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	994.2788	25.1600	250.1606	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	25.1600	622.4981	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	136.1139	25.1600	34.2463	(249)
Energy for lighting	153.5048	25.1600	38.6218	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-468.1613	25.1600	-117.7894	
PV Unit electricity exported	-244.8397	5.8100	-14.2252	
Total			-132.0146	(252)
Total energy cost			813.5121	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	994.2788	0.1578	156.8574	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2474.1578	0.1413	349.5790	(264)
Space and water heating			506.4364	(265)
Pumps, fans and electric keep-hot	136.1139	0.1387	18.8807	(267)
Energy for lighting	153.5048	0.1443	22.1555	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-468.1613	0.1322	-61.8791	
PV Unit electricity exported	-244.8397	0.1220	-29.8823	
Total			-91.7614	(269)
Total CO2, kg/year			455.7112	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	994.2788	1.5840	1574.8980	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	1.5225	3766.8228	(278)
Space and water heating			5341.7207	(279)
Pumps, fans and electric keep-hot	136.1139	1.5128	205.9132	(281)
Energy for lighting	153.5048	1.5338	235.4508	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-468.1613	1.4884	-696.7965	
PV Unit electricity exported	-244.8397	0.4479	-109.6588	
Total			-806.4554	(283)
Total Primary energy kWh/year			4976.6294	(286)

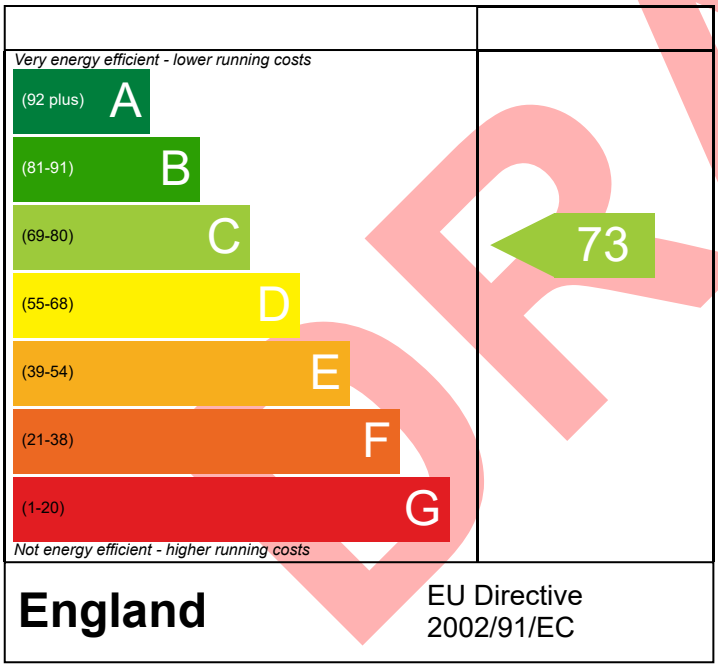
Predicted Energy Assessment

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	66.41 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

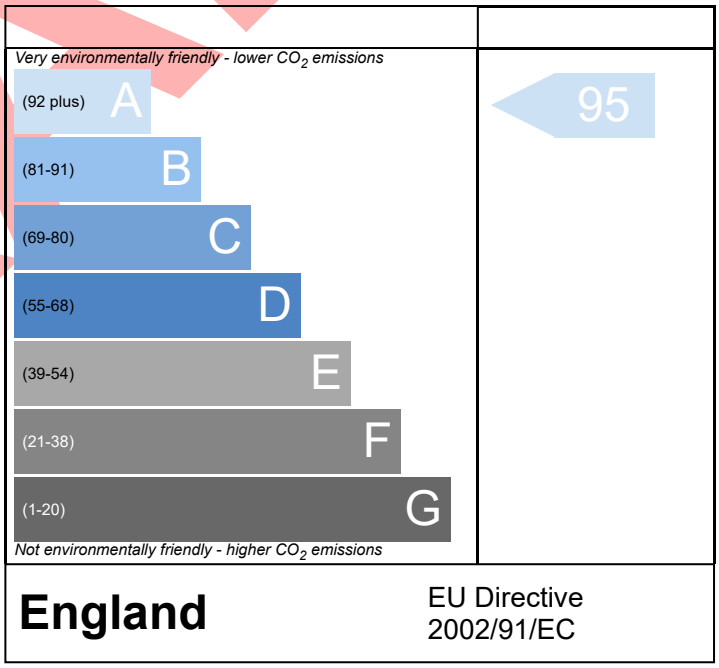
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:52

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	72 m^2
Site Reference	Unit 292 L01 _Copy	Plot Reference	Unit 292 L01_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*10.45 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	4.68 kgCO_2/m^2	**OK**
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*56.41 kWh$_{PE}$/m^2*	
Dwelling primary energy	52.87 kWh$_{PE}$/m^2	**OK**
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*18.9 kWh/m^2*	
Dwelling fabric energy efficiency	17.8 kWh/m^2	**OK**

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	**OK**
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	**OK**
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	16.81	0.14 **(!)**
Party wall: Party Wall (1)	41.71	0 **(!)**
Party wall: Party Wall (2)	22.81	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	11.81	North East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.93 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 292 L01 _Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 292 L01_Copy	**Prop Type Ref**	Unit 292 L01
Property			

SAP Rating	80 C	**DER**	4.68	**TER**	10.45
Environmental	96 A	**% DER < TER**			55.22
CO_2 Emissions (t/year)	0.33	**DFEE**	17.78	**TFEE**	18.90
Compliance Check	See BREL	**% DFEE < TFEE**			5.90
% DPER < TPER	6.27	**DPER**	52.87	**TPER**	56.41

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	71.6800	(1b)	x 2.4000	(2b) =	172.0320	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.6800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		172.0320	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												72.0000	(23c)
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	28.6200	11.8100	16.8100	0.1400	2.3534	14.0000	235.3400	(29a)
Total net area of external elements Aum(A, m2)			28.6200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.9475			(33)
Party Wall 1			41.7100	0.0000	0.0000	20.0000	834.2000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			71.6800			80.0000	5734.4000	(32d)
Party Ceiling 1			71.6800			80.0000	5734.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		14231.4100	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							198.5409	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545

E4 Jamb	13.9200	0.0500	0.6960	
E7 Party floor between dwellings (in blocks of flats)	10.6000	0.0700	0.7420	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.9000	0.0000	0.0000	
E16 Corner (normal)	2.7000	0.0900	0.2430	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.2595 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 19.2070 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3623	16.1974	16.0324	15.2074	15.0424	14.2175	14.2175	14.0525	14.5475	15.0424	15.3724	15.7024	(38)
Heat transfer coeff	35.5693	35.4044	35.2394	34.4144	34.2494	33.4245	33.4245	33.2595	33.7545	34.2494	34.5794	34.9094	(39)
Average = Sum(39)m / 12 =												34.3732	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4962	0.4939	0.4916	0.4801	0.4778	0.4663	0.4663	0.4640	0.4709	0.4778	0.4824	0.4870	(40)
HLP (average)												0.4795	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2862 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	86.0089	84.7163	82.8328	79.2291	76.5696	73.6038	71.9181	73.7873	75.8363	79.0207	82.7018	85.6793	(42a)
Hot water usage for baths	27.0226	26.6213	26.0561	25.0141	24.2338	23.3686	22.9013	23.4625	24.0735	24.9993	26.0628	26.9312	(42b)
Hot water usage for other uses	38.0431	36.6597	35.2763	33.8929	32.5095	31.1262	31.1262	32.5095	33.8929	35.2763	36.6597	38.0431	(42c)
Average daily hot water use (litres/day)												138.9361	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.0745	147.9973	144.1652	138.1361	133.3130	128.0986	125.9455	129.7594	133.8028	139.2963	145.4243	150.6536	(44)
Energy conte	239.2651	210.7461	221.5766	189.1014	179.4649	157.5122	152.3202	160.6692	164.9922	189.0238	207.1836	235.8872	(45)
Energy content (annual)										Total = Sum(45)m =		2307.7426	
Distribution loss (46)m = 0.15 x (45)m	35.8898	31.6119	33.2365	28.3652	26.9197	23.6268	22.8480	24.1004	24.7488	28.3536	31.0775	35.3831	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)
										Total per year (kWh/year) = Sum(64)m =		2554.7746	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	96.3403	85.2334	90.4589	79.1194	76.4567	68.6160	67.4311	70.2071	71.1031	79.6351	85.1318	95.2171	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.3930	20.7775	16.8974	12.7924	9.5625	8.0730	8.7232	11.3387	15.2188	19.3238	22.5537	24.0432	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	300.2774	303.3934	295.5413	278.8252	257.7241	237.8920	224.6430	221.5270	229.3791	246.0952	267.1963	287.0284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	(71)
Water heating gains (Table 5)	129.4896	126.8354	121.5845	109.8881	102.7644	95.3000	90.6332	94.3644	98.7543	107.0364	118.2386	127.9800	(72)
Total internal gains	549.8877	547.7339	530.7508	498.2333	466.7786	437.9927	420.7271	423.9579	440.0799	469.1831	504.7163	535.7792	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(75)

Solar gains	48.1118	97.9329	176.4440	289.7718	389.5101	415.2590	388.4663	309.6898	214.9998	119.6818	60.5371	39.2905	(83)
Total gains	597.9995	645.6669	707.1948	788.0051	856.2887	853.2517	809.1933	733.6477	655.0797	588.8649	565.2534	575.0697	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	111.1398	111.6577	112.1805	114.8696	115.4229	118.2717	118.2717	118.8584	117.1155	115.4229	114.3215	113.2409	
alpha	8.4093	8.4438	8.4787	8.6580	8.6949	8.8848	8.8848	8.9239	8.8077	8.6949	8.6214	8.5494	
util living area													
	0.8907	0.8306	0.7092	0.5274	0.3719	0.2507	0.1817	0.2085	0.3555	0.6018	0.8105	0.9039	(86)
MIT	20.8722	20.9298	20.9803	20.9984	20.9999	21.0000	21.0000	21.0000	21.0000	20.9963	20.9530	20.8608	(87)
Th 2	20.5243	20.5264	20.5285	20.5391	20.5412	20.5518	20.5518	20.5539	20.5476	20.5412	20.5370	20.5327	(88)
util rest of house													
	0.8771	0.8135	0.6886	0.5076	0.3536	0.2332	0.1632	0.1883	0.3322	0.5761	0.7902	0.8914	(89)
MIT 2	20.3839	20.4516	20.5087	20.5376	20.5412	20.5518	20.5518	20.5539	20.5476	20.5379	20.4887	20.3786	(90)
Living area fraction										fLA = Living area / (4) =		0.4021	(91)
MIT	20.5802	20.6438	20.6983	20.7228	20.7256	20.7320	20.7320	20.7333	20.7295	20.7222	20.6754	20.5725	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5802	20.6438	20.6983	20.7228	20.7256	20.7320	20.7320	20.7333	20.7295	20.7222	20.6754	20.5725	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8788	0.8178	0.6961	0.5155	0.3610	0.2402	0.1707	0.1964	0.3416	0.5863	0.7964	0.8925	(94)
Useful gains	525.5185	528.0545	492.2508	406.2317	309.0939	204.9590	138.1105	144.1228	223.7621	345.2470	450.1599	513.2582	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	579.0763	557.4003	500.3404	406.8764	309.1219	204.9594	138.1105	144.1229	223.7735	346.6793	469.4288	571.5536	(97)
Space heating kWh	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(98a)
Space heating requirement - total per year (kWh/year)												124.3821	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												124.3821	
Space heating per m2											(98c) / (4) =	1.7352	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.2264	11.9464	13.2264	12.7997	13.2264	12.7997	13.2264	13.2264	12.7997	13.2264	12.7997	13.2264	(231)
Lighting	20.4758	16.4264	14.7902	10.8359	8.3700	6.8383	7.6354	9.9247	12.8912	16.9140	19.1043	21.0448	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-17.0008	-26.9528	-43.7049	-55.0326	-64.6365	-62.1981	-61.2076	-55.2744	-45.1885	-33.0016	-19.5873	-14.3353	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.4971	-8.1867	-18.2196	-30.3147	-42.3617	-43.5158	-42.8995	-34.7392	-23.7344	-12.5240	-4.9201	-2.6818	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												124.3821	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2554.7746	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)													
mechanical ventilation fans (SFP = 0.7420)												155.7302	(230a)
Total electricity for the above, kWh/year												155.7302	(231)
Electricity for lighting (calculated in Appendix L)												165.2510	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-765.7149	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)

Appendix Q - special features

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2234.4231	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	124.3821	16.4900	20.5106	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	16.4900	421.2823	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	155.7302	16.4900	25.6799	(249)
Energy for lighting	165.2510	16.4900	27.2499	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.1204	16.4900	-82.1401	
PV Unit electricity exported	-267.5945	5.5900	-14.9585	
Total			-97.0986	(252)
Total energy cost			397.6242	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2268	(257)
SAP value	80.1133	
SAP rating (Section 12)	80	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	124.3821	0.1604	19.9497	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2554.7746	0.1413	360.9927	(264)
Space and water heating			380.9424	(265)
Pumps, fans and electric keep-hot	155.7302	0.1387	21.6017	(267)
Energy for lighting	165.2510	0.1443	23.8508	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.1204	0.1323	-65.9162	
PV Unit electricity exported	-267.5945	0.1234	-33.0212	
Total			-98.9374	(269)
Total CO2, kg/year			327.4575	(272)
CO2 emissions per m2			4.5700	(273)
EI value			96.2393	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	71.6800	(1b)	x 2.4000	(2b) =	172.0320	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 71.6800						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		172.0320	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 = 0.0000	(6a)
Number of open flues	0 * 20 = 0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000	(6d)
Number of flues attached to other heater	0 * 35 = 0.0000	(6e)
Number of blocked chimneys	0 * 20 = 0.0000	(6f)
Number of intermittent extract fans	0 * 10 = 0.0000	(7a)
Number of passive vents	0 * 10 = 0.0000	(7b)
Number of flueless gas fires	0 * 40 = 0.0000	(7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000	(8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	3.0000	(17)
Infiltration rate	0.1500	(18)
Number of sides sheltered	3	(19)
Shelter factor (20) = 1 - [0.075 x (19)] =	0.7750	(20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	28.6200	11.8100	16.8100	0.1400	2.3534	14.0000	235.3400	(29a)
Total net area of external elements Aum(A, m2)			28.6200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.9475			(33)
Party Wall 1			41.7100	0.0000	0.0000	20.0000	834.2000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			71.6800			80.0000	5734.4000	(32d)
Party Ceiling 1			71.6800			80.0000	5734.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14231.4100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 198.5409 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	10.6000	0.0700	0.7420
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.9000	0.0000	0.0000
E16 Corner (normal)	2.7000	0.0900	0.2430

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 0.2595 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 19.2070 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.5273	16.5273	16.1974	15.2074	15.0424	14.3825	14.0525	14.0525	14.7124	15.5374	15.8674	15.7024	(38)
Heat transfer coeff	35.7343	35.7343	35.4044	34.4144	34.2494	33.5895	33.2595	33.2595	33.9195	34.7444	35.0744	34.9094	(39)

Average = Sum(39)m / 12 = 34.5244

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4985	0.4985	0.4939	0.4801	0.4778	0.4686	0.4640	0.4640	0.4732	0.4847	0.4893	0.4870	(40)
HLP (average)												0.4816	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2862 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	86.0089	84.7163	82.8328	79.2291	76.5696	73.6038	71.9181	73.7873	75.8363	79.0207	82.7018	85.6793	(42a)
Hot water usage for baths	27.0226	26.6213	26.0561	25.0141	24.2338	23.3686	22.9013	23.4625	24.0735	24.9993	26.0628	26.9312	(42b)
Hot water usage for other uses	38.0431	36.6597	35.2763	33.8929	32.5095	31.1262	31.1262	32.5095	33.8929	35.2763	36.6597	38.0431	(42c)

Average daily hot water use (litres/day) 138.9361 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.0745	147.9973	144.1652	138.1361	133.3130	128.0986	125.9455	129.7594	133.8028	139.2963	145.4243	150.6536	(44)
Energy conte	239.2651	210.7461	221.5766	189.1014	179.4649	157.5122	152.3202	160.6692	164.9922	189.0238	207.1836	235.8872	(45)

Energy content (annual) Total = Sum(45)m = 2307.7426

Distribution loss (46)m = 0.15 x (45)m	35.8898	31.6119	33.2365	28.3652	26.9197	23.6268	22.8480	24.1004	24.7488	28.3536	31.0775	35.3831	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)

Total per year (kWh/year) = Sum(64)m = 2554.7746 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	96.3403	85.2334	90.4589	79.1194	76.4567	68.6160	67.4311	70.2071	71.1031	79.6351	85.1318	95.2171	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.3930	20.7775	16.8974	12.7924	9.5625	8.0730	8.7232	11.3387	15.2188	19.3238	22.5537	24.0432	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	300.2774	303.3934	295.5413	278.8252	257.7241	237.8920	224.6430	221.5270	229.3791	246.0952	267.1963	287.0284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	(71)
Water heating gains (Table 5)													
	129.4896	126.8354	121.5845	109.8881	102.7644	95.3000	90.6332	94.3644	98.7543	107.0364	118.2386	127.9800	(72)
Total internal gains													
	549.8877	547.7339	530.7508	498.2333	466.7786	437.9927	420.7271	423.9579	440.0799	469.1831	504.7163	535.7792	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(75)

Solar gains	42.7730	92.6022	174.0550	301.5827	403.2921	419.0362	396.3745	305.8819	210.3213	112.3593	55.2465	35.7661	(83)
Total gains	592.6608	640.3361	704.8058	799.8160	870.0707	857.0289	817.1015	729.8397	650.4012	581.5423	559.9628	571.5453	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	110.6266	110.6266	111.6577	114.8696	115.4229	117.6907	118.8584	118.8584	116.5458	113.7786	112.7082	113.2409	
alpha	8.3751	8.3751	8.4438	8.6580	8.6949	8.8460	8.9239	8.9239	8.7697	8.5852	8.5139	8.5494	
util living area													
	0.9065	0.8593	0.7516	0.5619	0.4054	0.3057	0.2483	0.2825	0.4275	0.6674	0.8432	0.9182	(86)
MIT	20.8464	20.9031	20.9677	20.9971	20.9998	21.0000	21.0000	21.0000	20.9998	20.9906	20.9314	20.8348	(87)
Th 2	20.5222	20.5222	20.5264	20.5391	20.5412	20.5497	20.5539	20.5539	20.5455	20.5349	20.5306	20.5327	(88)
util rest of house													
	0.8943	0.8439	0.7321	0.5426	0.3873	0.2881	0.2301	0.2622	0.4039	0.6418	0.8246	0.9073	(89)
MIT 2	20.3514	20.4171	20.4931	20.5364	20.5411	20.5497	20.5539	20.5539	20.5453	20.5262	20.4588	20.3477	(90)
Living area fraction									fLA = Living area / (4) =			0.4021	(91)
MIT	20.5504	20.6125	20.6839	20.7216	20.7255	20.7307	20.7333	20.7333	20.7280	20.7130	20.6488	20.5436	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5504	20.6125	20.6839	20.7216	20.7255	20.7307	20.7333	20.7333	20.7280	20.7130	20.6488	20.5436	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8951	0.8469	0.7387	0.5502	0.3946	0.2951	0.2374	0.2704	0.4134	0.6517	0.8294	0.9075	(94)
Useful gains	530.4783	542.2746	520.6325	440.0970	343.3043	252.9499	194.0117	197.3368	268.8466	378.9737	464.4567	518.6920	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	594.9914	582.9178	534.0374	441.2484	343.3684	252.9535	194.0121	197.3380	268.9149	382.6385	492.7526	587.9989	(97)
Space heating kWh													
	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643	(98a)
Space heating requirement - total per year (kWh/year)												160.8238	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												160.8238	
Space heating per m2										(98c) / (4) =		2.2436	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(219)
Space cooling fuel requirement													

(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.2264	11.9464	13.2264	12.7997	13.2264	12.7997	13.2264	13.2264	12.7997	13.2264	12.7997	13.2264	(231)
Lighting	20.4758	16.4264	14.7902	10.8359	8.3700	6.8383	7.6354	9.9247	12.8912	16.9140	19.1043	21.0448	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.4126	-25.9729	-43.7522	-57.3553	-66.8995	-63.0965	-62.6159	-55.2911	-44.8919	-31.6377	-18.2309	-13.2576	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.9589	-7.6180	-18.1511	-32.6607	-45.1941	-44.7217	-44.8029	-34.7587	-23.4550	-11.6200	-4.3363	-2.3448	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	160.8238	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2554.7746	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	155.7302	(230a)
Total electricity for the above, kWh/year	155.7302	(231)
Electricity for lighting (calculated in Appendix L)	165.2510	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-771.0360	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2265.5437	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	160.8238	25.1600	40.4633	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	25.1600	642.7813	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	155.7302	25.1600	39.1817	(249)
Energy for lighting	165.2510	25.1600	41.5772	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.4140	25.1600	-125.4010	
PV Unit electricity exported	-272.6220	5.8100	-15.8393	
Total			-141.2403	(252)
Total energy cost			622.7632	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	160.8238	0.1598	25.6965	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2554.7746	0.1413	360.9927	(264)
Space and water heating			386.6891	(265)
Pumps, fans and electric keep-hot	155.7302	0.1387	21.6017	(267)
Energy for lighting	165.2510	0.1443	23.8508	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.4140	0.1320	-65.8025	
PV Unit electricity exported	-272.6220	0.1229	-33.5042	
Total			-99.3067	(269)
Total CO2, kg/year			332.8350	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	160.8238	1.5914	255.9292	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	1.5225	3889.6458	(278)
Space and water heating			4145.5750	(279)
Pumps, fans and electric keep-hot	155.7302	1.5128	235.5887	(281)
Energy for lighting	165.2510	1.5338	253.4676	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.4140	1.4878	-741.5395	
PV Unit electricity exported	-272.6220	0.4510	-122.9601	
Total			-864.4997	(283)
Total Primary energy kWh/year			3770.1316	(286)

SAP 10 EPC IMPROVEMENTS

Unit 292 L01_Copy

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 80
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£764	£764	£0
Space heating	£80	£80	£0
Water heating	£643	£643	£0
Lighting	£42	£42	£0
Generated (PV)	-£141	-£141	£0
Total cost of fuels	£623	£623	£0
Total cost of uses	£624	£624	£0
Delivered energy	32 kWh/m²	32 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	53 kWh/m²	53 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	71.6800 (1b)	x	2.4000 (2b)	=	172.0320	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.6800					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	172.0320	(5)

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2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	28.6200	11.8100	16.8100	0.1400	2.3534	14.0000	235.3400	(29a)
Total net area of external elements Aum(A, m2)			28.6200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.9475			(33)
Party Wall 1			41.7100	0.0000	0.0000	20.0000	834.2000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			71.6800			80.0000	5734.4000	(32d)
Party Ceiling 1			71.6800			80.0000	5734.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14231.4100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 198.5409 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	10.6000	0.0700	0.7420
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.9000	0.0000	0.0000
E16 Corner (normal)	2.7000	0.0900	0.2430

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.2595 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 19.2070 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3623	16.1974	16.0324	15.2074	15.0424	14.2175	14.2175	14.0525	14.5475	15.0424	15.3724	15.7024	(38)
Heat transfer coeff	35.5693	35.4044	35.2394	34.4144	34.2494	33.4245	33.4245	33.2595	33.7545	34.2494	34.5794	34.9094	(39)
Average = Sum(39)m / 12 =												34.3732	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4962	0.4939	0.4916	0.4801	0.4778	0.4663	0.4663	0.4640	0.4709	0.4778	0.4824	0.4870	(40)
HLP (average)												0.4795	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2862 (42)
Hot water usage for mixer showers

86.0089	84.7163	82.8328	79.2291	76.5696	73.6038	71.9181	73.7873	75.8363	79.0207	82.7018	85.6793	(42a)

Hot water usage for baths

27.0226	26.6213	26.0561	25.0141	24.2338	23.3686	22.9013	23.4625	24.0735	24.9993	26.0628	26.9312	(42b)

Hot water usage for other uses

38.0431	36.6597	35.2763	33.8929	32.5095	31.1262	31.1262	32.5095	33.8929	35.2763	36.6597	38.0431	(42c)

Average daily hot water use (litres/day) 138.9361 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.0745	147.9973	144.1652	138.1361	133.3130	128.0986	125.9455	129.7594	133.8028	139.2963	145.4243	150.6536	(44)
Energy conte	239.2651	210.7461	221.5766	189.1014	179.4649	157.5122	152.3202	160.6692	164.9922	189.0238	207.1836	235.8872	(45)
Energy content (annual)										Total = Sum(45)m =		2307.7426	
Distribution loss (46)m = 0.15 x (45)m	35.8898	31.6119	33.2365	28.3652	26.9197	23.6268	22.8480	24.1004	24.7488	28.3536	31.0775	35.3831	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)

Total per year (kWh/year) = Sum(64)m = 2554.7746 (64)
Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month

96.3403	85.2334	90.4589	79.1194	76.4567	68.6160	67.4311	70.2071	71.1031	79.6351	85.1318	95.2171	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.3930	20.7775	16.8974	12.7924	9.5625	8.0730	8.7232	11.3387	15.2188	19.3238	22.5537	24.0432	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	300.2774	303.3934	295.5413	278.8252	257.7241	237.8920	224.6430	221.5270	229.3791	246.0952	267.1963	287.0284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	(71)
Water heating gains (Table 5)	129.4896	126.8354	121.5845	109.8881	102.7644	95.3000	90.6332	94.3644	98.7543	107.0364	118.2386	127.9800	(72)
Total internal gains	549.8877	547.7339	530.7508	498.2333	466.7786	437.9927	420.7271	423.9579	440.0799	469.1831	504.7163	535.7792	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(75)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	48.1118	97.9329	176.4440	289.7718	389.5101	415.2590	388.4663	309.6898	214.9998	119.6818	60.5371	39.2905	(83)
Total gains	597.9995	645.6669	707.1948	788.0051	856.2887	853.2517	809.1933	733.6477	655.0797	588.8649	565.2534	575.0697	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	111.1398	111.6577	112.1805	114.8696	115.4229	118.2717	118.2717	118.8584	117.1155	115.4229	114.3215	113.2409	
alpha	8.4093	8.4438	8.4787	8.6580	8.6949	8.8848	8.8848	8.9239	8.8077	8.6949	8.6214	8.5494	
util living area	0.8907	0.8306	0.7092	0.5274	0.3719	0.2507	0.1817	0.2085	0.3555	0.6018	0.8105	0.9039	(86)
MIT	20.8722	20.9298	20.9803	20.9984	20.9999	21.0000	21.0000	21.0000	21.0000	20.9963	20.9530	20.8608	(87)
Th 2	20.5243	20.5264	20.5285	20.5391	20.5412	20.5518	20.5518	20.5539	20.5476	20.5412	20.5370	20.5327	(88)
util rest of house	0.8771	0.8135	0.6886	0.5076	0.3536	0.2332	0.1632	0.1883	0.3322	0.5761	0.7902	0.8914	(89)
MIT 2	20.3839	20.4516	20.5087	20.5376	20.5412	20.5518	20.5518	20.5539	20.5476	20.5379	20.4887	20.3786	(90)
Living area fraction										fLA = Living area / (4) =		0.4021	(91)
MIT	20.5802	20.6438	20.6983	20.7228	20.7256	20.7320	20.7320	20.7333	20.7295	20.7222	20.6754	20.5725	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5802	20.6438	20.6983	20.7228	20.7256	20.7320	20.7320	20.7333	20.7295	20.7222	20.6754	20.5725	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8788	0.8178	0.6961	0.5155	0.3610	0.2402	0.1707	0.1964	0.3416	0.5863	0.7964	0.8925	(94)
Useful gains	525.5185	528.0545	492.2508	406.2317	309.0939	204.9590	138.1105	144.1228	223.7621	345.2470	450.1599	513.2582	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	579.0763	557.4003	500.3404	406.8764	309.1219	204.9594	138.1105	144.1229	223.7735	346.6793	469.4288	571.5536	(97)
Space heating kWh	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(98a)
Space heating requirement - total per year (kWh/year)												124.3821	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												124.3821	
Space heating per m2										(98c) / (4) =		1.7352	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.2264	11.9464	13.2264	12.7997	13.2264	12.7997	13.2264	13.2264	12.7997	13.2264	12.7997	13.2264	(231)
Lighting	20.4758	16.4264	14.7902	10.8359	8.3700	6.8383	7.6354	9.9247	12.8912	16.9140	19.1043	21.0448	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-17.0008	-26.9528	-43.7049	-55.0326	-64.6365	-62.1981	-61.2076	-55.2744	-45.1885	-33.0016	-19.5873	-14.3353	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.4971	-8.1867	-18.2196	-30.3147	-42.3617	-43.5158	-42.8995	-34.7392	-23.7344	-12.5240	-4.9201	-2.6818	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	124.3821	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2554.7746	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	155.7302	(230a)
Total electricity for the above, kWh/year	155.7302	(231)
Electricity for lighting (calculated in Appendix L)	165.2510	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-765.7149	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2234.4231	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	124.3821	16.4900	20.5106	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	16.4900	421.2823	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	155.7302	16.4900	25.6799	(249)
Energy for lighting	165.2510	16.4900	27.2499	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.1204	16.4900	-82.1401	
PV Unit electricity exported	-267.5945	5.5900	-14.9585	
Total			-97.0986	(252)
Total energy cost			397.6242	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2268	(257)
SAP value	80.1133	
SAP rating (Section 12)	80	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	124.3821	0.1604	19.9497	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2554.7746	0.1413	360.9927	(264)
Space and water heating			380.9424	(265)
Pumps, fans and electric keep-hot	155.7302	0.1387	21.6017	(267)
Energy for lighting	165.2510	0.1443	23.8508	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.1204	0.1323	-65.9162	
PV Unit electricity exported	-267.5945	0.1234	-33.0212	
Total			-98.9374	(269)
Total CO2, kg/year			327.4575	(272)
CO2 emissions per m2			4.5700	(273)
EI value			96.2393	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	71.6800	(1b)	x 2.4000	(2b) =	172.0320	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 71.6800						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		172.0320	(5)

2. Ventilation rate

m3 per hour

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	28.6200	11.8100	16.8100	0.1400	2.3534	14.0000	235.3400	(29a)
Total net area of external elements Aum(A, m2)			28.6200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.9475			(33)
Party Wall 1			41.7100	0.0000	0.0000	20.0000	834.2000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			71.6800			80.0000	5734.4000	(32d)
Party Ceiling 1			71.6800			80.0000	5734.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14231.4100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		198.5409 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	10.6000	0.0700	0.7420
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.9000	0.0000	0.0000
E16 Corner (normal)	2.7000	0.0900	0.2430

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		2.2595 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	19.2070 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.5273	16.5273	16.1974	15.2074	15.0424	14.3825	14.0525	14.0525	14.7124	15.5374	15.8674	15.7024	(38)
Heat transfer coeff	35.7343	35.7343	35.4044	34.4144	34.2494	33.5895	33.2595	33.2595	33.9195	34.7444	35.0744	34.9094	(39)
Average = Sum(39)m / 12 =												34.5244	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4985	0.4985	0.4939	0.4801	0.4778	0.4686	0.4640	0.4640	0.4732	0.4847	0.4893	0.4870	(40)
HLP (average)												0.4816	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.2862 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
86.0089	84.7163	82.8328	79.2291	76.5696	73.6038	71.9181	73.7873	75.8363	79.0207	82.7018	85.6793	(42a)

Hot water usage for baths

27.0226	26.6213	26.0561	25.0141	24.2338	23.3686	22.9013	23.4625	24.0735	24.9993	26.0628	26.9312	(42b)

Hot water usage for other uses

38.0431	36.6597	35.2763	33.8929	32.5095	31.1262	31.1262	32.5095	33.8929	35.2763	36.6597	38.0431	(42c)

Average daily hot water use (litres/day)	138.9361 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.0745	147.9973	144.1652	138.1361	133.3130	128.0986	125.9455	129.7594	133.8028	139.2963	145.4243	150.6536	(44)
Energy conte	239.2651	210.7461	221.5766	189.1014	179.4649	157.5122	152.3202	160.6692	164.9922	189.0238	207.1836	235.8872	(45)
Energy content (annual)											Total = Sum(45)m =	2307.7426	

Distribution loss (46)m = 0.15 x (45)m

35.8898	31.6119	33.2365	28.3652	26.9197	23.6268	22.8480	24.1004	24.7488	28.3536	31.0775	35.3831	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680 (64)
										Total per year (kWh/year) = Sum(64)m =		2554.7746 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000 (64a)
Heat gains from water heating, kWh/month												
	96.3403	85.2334	90.4589	79.1194	76.4567	68.6160	67.4311	70.2071	71.1031	79.6351	85.1318	95.2171 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.3930	20.7775	16.8974	12.7924	9.5625	8.0730	8.7232	11.3387	15.2188	19.3238	22.5537	24.0432	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	300.2774	303.3934	295.5413	278.8252	257.7241	237.8920	224.6430	221.5270	229.3791	246.0952	267.1963	287.0284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	(71)
Water heating gains (Table 5)													
	129.4896	126.8354	121.5845	109.8881	102.7644	95.3000	90.6332	94.3644	98.7543	107.0364	118.2386	127.9800	(72)
Total internal gains													
	549.8877	547.7339	530.7508	498.2333	466.7786	437.9927	420.7271	423.9579	440.0799	469.1831	504.7163	535.7792	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(75)

Solar gains	42.7730	92.6022	174.0550	301.5827	403.2921	419.0362	396.3745	305.8819	210.3213	112.3593	55.2465	35.7661	(83)
Total gains	592.6608	640.3361	704.8058	799.8160	870.0707	857.0289	817.1015	729.8397	650.4012	581.5423	559.9628	571.5453	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	110.6266	110.6266	111.6577	114.8696	115.4229	117.6907	118.8584	118.8584	116.5458	113.7786	112.7082	113.2409	
alpha	8.3751	8.3751	8.4438	8.6580	8.6949	8.8460	8.9239	8.9239	8.7697	8.5852	8.5139	8.5494	
util living area													
	0.9065	0.8593	0.7516	0.5619	0.4054	0.3057	0.2483	0.2825	0.4275	0.6674	0.8432	0.9182	(86)
MIT	20.8464	20.9031	20.9677	20.9971	20.9998	21.0000	21.0000	21.0000	20.9998	20.9906	20.9314	20.8348	(87)
Th 2	20.5222	20.5222	20.5264	20.5391	20.5412	20.5497	20.5539	20.5539	20.5455	20.5349	20.5306	20.5327	(88)
util rest of house													
	0.8943	0.8439	0.7321	0.5426	0.3873	0.2881	0.2301	0.2622	0.4039	0.6418	0.8246	0.9073	(89)
MIT 2	20.3514	20.4171	20.4931	20.5364	20.5411	20.5497	20.5539	20.5539	20.5453	20.5262	20.4588	20.3477	(90)
Living area fraction										fLA = Living area / (4) =		0.4021	(91)
MIT	20.5504	20.6125	20.6839	20.7216	20.7255	20.7307	20.7333	20.7333	20.7280	20.7130	20.6488	20.5436	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5504	20.6125	20.6839	20.7216	20.7255	20.7307	20.7333	20.7333	20.7280	20.7130	20.6488	20.5436	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8951	0.8469	0.7387	0.5502	0.3946	0.2951	0.2374	0.2704	0.4134	0.6517	0.8294	0.9075	(94)
Useful gains	530.4783	542.2746	520.6325	440.0970	343.3043	252.9499	194.0117	197.3368	268.8466	378.9737	464.4567	518.6920	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	594.9914	582.9178	534.0374	441.2484	343.3684	252.9535	194.0121	197.3380	268.9149	382.6385	492.7526	587.9989	(97)
Space heating kWh													
	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643	(98a)
Space heating requirement - total per year (kWh/year)												160.8238	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												160.8238	
Space heating per m2											(98c) / (4) =	2.2436	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement												

	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643 (98)
Space heating efficiency (main heating system 1)												
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)												
	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	13.2264	11.9464	13.2264	12.7997	13.2264	12.7997	13.2264	13.2264	12.7997	13.2264	12.7997	13.2264 (231)
Lighting	20.4758	16.4264	14.7902	10.8359	8.3700	6.8383	7.6354	9.9247	12.8912	16.9140	19.1043	21.0448 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-15.4126	-25.9729	-43.7522	-57.3553	-66.8995	-63.0965	-62.6159	-55.2911	-44.8919	-31.6377	-18.2309	-13.2576 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.9589	-7.6180	-18.1511	-32.6607	-45.1941	-44.7217	-44.8029	-34.7587	-23.4550	-11.6200	-4.3363	-2.3448 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	160.8238 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2554.7746 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	155.7302 (230a)
Total electricity for the above, kWh/year	155.7302 (231)
Electricity for lighting (calculated in Appendix L)	165.2510 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-771.0360 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2265.5437 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	160.8238	25.1600	40.4633	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	25.1600	642.7813	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	155.7302	25.1600	39.1817	(249)
Energy for lighting	165.2510	25.1600	41.5772	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.4140	25.1600	-125.4010	
PV Unit electricity exported	-272.6220	5.8100	-15.8393	
Total			-141.2403	(252)
Total energy cost			622.7632	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	160.8238	0.1598	25.6965	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2554.7746	0.1413	360.9927	(264)
Space and water heating			386.6891	(265)
Pumps, fans and electric keep-hot	155.7302	0.1387	21.6017	(267)
Energy for lighting	165.2510	0.1443	23.8508	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.4140	0.1320	-65.8025	
PV Unit electricity exported	-272.6220	0.1229	-33.5042	
Total			-99.3067	(269)
Total CO2, kg/year			332.8350	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	

Space heating - main system 1	160.8238	1.5914	255.9292	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	1.5225	3889.6458	(278)
Space and water heating			4145.5750	(279)
Pumps, fans and electric keep-hot	155.7302	1.5128	235.5887	(281)
Energy for lighting	165.2510	1.5338	253.4676	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.4140	1.4878	-741.5395	
PV Unit electricity exported	-272.6220	0.4510	-122.9601	
Total			-864.4997	(283)
Total Primary energy kWh/year			3770.1316	(286)

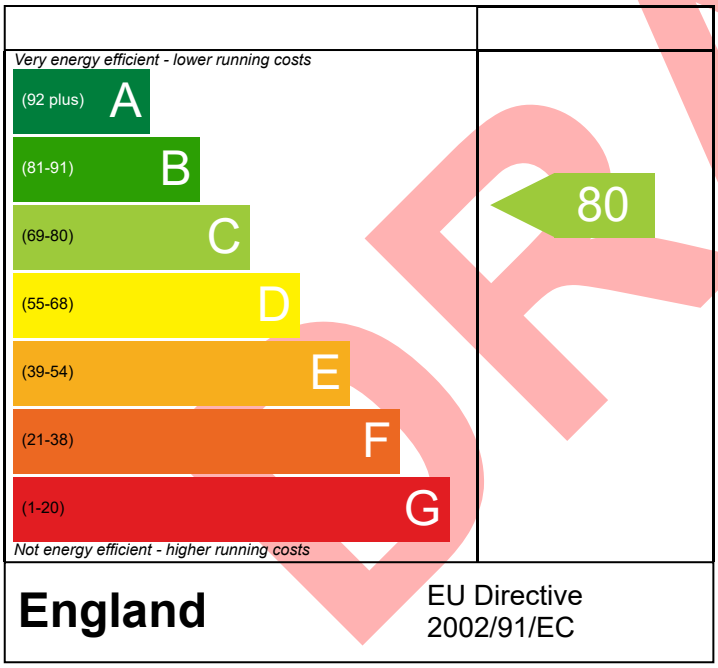
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	71.68 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

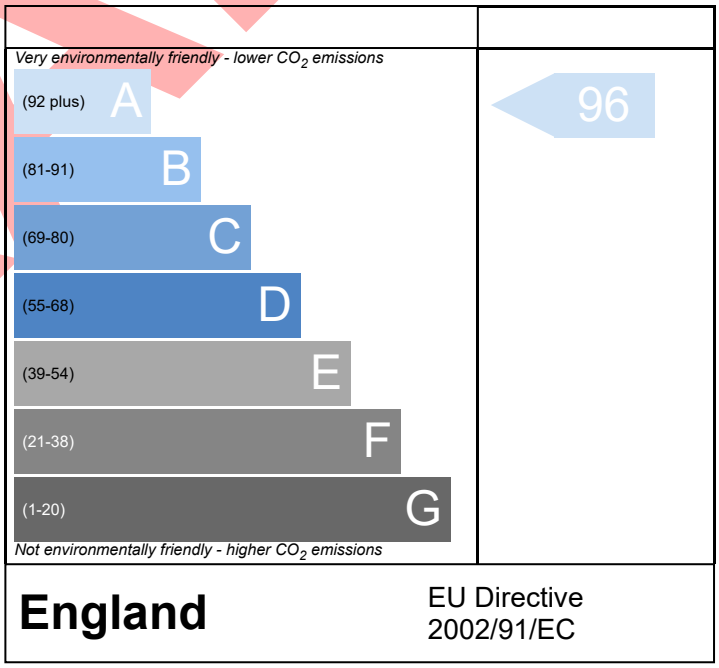
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:52

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	64 m^2
Site Reference	Unit 293 L01 _Copy	Plot Reference	Unit 293 L01_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*12.3 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	6.25 kgCO_2/m^2	**OK**
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*66.47 kWh$_{PE}$/m^2*	
Dwelling primary energy	68.78 kWh$_{PE}$/m^2	**FAIL**
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*25.8 kWh/m^2*	
Dwelling fabric energy efficiency	28.7 kWh/m^2	**FAIL**

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	**OK**
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	**OK**
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	21.07	0.14 **(!)**
Party wall: Party Wall (1)	37.53	0 **(!)**
Party wall: Party Wall (2)	6.68	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	7.88	North East	0.83	1.3
N, Opening Type 1	2.11	North	0.83	1.3
NW, Opening Type 1	11.81	North West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.82 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 293 L01 _Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 293 L01_Copy	**Prop Type Ref**	Unit 293 L01
Property			

SAP Rating	76 C	**DER**	6.25	**TER**	12.30
Environmental	95 A	**% DER < TER**			49.19
CO_2 Emissions (t/year)	0.4	**DFEE**	28.70	**TFEE**	25.80
Compliance Check	See BREL	**% DFEE < TFEE**			-11.22
% DPER < TPER	-3.48	**DPER**	68.78	**TPER**	66.47

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.6600 (1b)	x	2.4000 (2b)	=	152.7840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.6600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	152.7840	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			21.8000	1.2357	26.9392			(27)
External Wall 1	42.8700	21.8000	21.0700	0.1400	2.9498	14.0000	294.9800	(29a)
Total net area of external elements Aum(A, m2)			42.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.8890			(33)
Party Wall 1			37.5300	0.0000	0.0000	20.0000	750.6000	(32)
Wall to corridor			6.6800	0.0000	0.0000	20.0000	133.6000	(32)
Party Floor 1			63.6600			80.0000	5092.8000	(32d)
Party Ceiling 1			63.6600			80.0000	5092.8000	(32b)
Internal Wall 1			123.2200			9.0000	1108.9800	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12473.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		195.9434 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	9.3800	0.0500	0.4690

E4 Jamb	27.8400	0.0500	1.3920	
E7 Party floor between dwellings (in blocks of flats)	15.8700	0.0700	1.1109	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3700	0.0000	0.0000	
E16 Corner (normal)	5.4000	0.0900	0.4860	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.7819 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 33.6709 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.2548	15.0941	14.9334	14.1298	13.9691	13.1656	13.1656	13.0049	13.4870	13.9691	14.2906	14.6120	(38)
Heat transfer coeff	48.9257	48.7650	48.6043	47.8007	47.6400	46.8365	46.8365	46.6757	47.1579	47.6400	47.9614	48.2828	(39)
Average = Sum(39)m / 12 =												47.7605	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7685	0.7660	0.7635	0.7509	0.7484	0.7357	0.7357	0.7332	0.7408	0.7484	0.7534	0.7584	(40)
HLP (average)												0.7502	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0830 (42)

Hot water usage for mixer showers

81.3240	80.1018	78.3209	74.9135	72.3989	69.5946	68.0007	69.7681	71.7056	74.7165	78.1971	81.0124	(42a)

Hot water usage for baths

25.5574	25.1778	24.6433	23.6578	22.9198	22.1016	21.6596	22.1903	22.7682	23.6438	24.6497	25.4710	(42b)

Hot water usage for other uses

35.9620	34.6543	33.3466	32.0389	30.7312	29.4235	29.4235	30.7312	32.0389	33.3466	34.6543	35.9620	(42c)

Average daily hot water use (litres/day) 131.3665 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	142.8434	139.9340	136.3109	130.6102	126.0499	121.1197	119.0838	122.6897	126.5127	131.7069	137.5011	142.4454	(44)
Energy conte	226.2290	199.2641	209.5047	178.7988	169.6874	148.9308	144.0215	151.9154	156.0028	178.7250	195.8955	223.0351	(45)
Energy content (annual)										Total = Sum(45)m =		2182.0102	
Distribution loss (46)m = 0.15 x (45)m	33.9344	29.8896	31.4257	26.8198	25.4531	22.3396	21.6032	22.7873	23.4004	26.8088	29.3843	33.4553	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
									Total per year (kWh/year) = Sum(64)m =		2429.0422	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

92.0058	81.4156	86.4450	75.6938	73.2057	65.7627	64.6718	67.2965	68.1141	76.2107	81.3784	90.9438	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.9586	18.6152	15.1389	11.4611	8.5673	7.2329	7.8154	10.1588	13.6351	17.3128	20.2066	21.5411	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	271.7527	274.5726	267.4664	252.3383	233.2416	215.2935	203.3031	200.4831	207.5893	222.7175	241.8141	259.7622	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	(71)
Water heating gains (Table 5)	123.6637	121.1542	116.1895	105.1303	98.3948	91.3371	86.9244	90.4523	94.6030	102.4338	113.0256	122.2363	(72)
Total internal gains	507.6160	505.5831	490.0359	460.1707	431.4448	405.1046	389.2840	392.3353	407.0684	433.7051	466.2874	494.7806	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1100	10.6334	0.6300	0.8270	0.7700	8.1009	(74)
Northeast	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(75)
Northwest	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(81)

Solar gains	88.3144	178.7581	320.4794	525.3714	706.3245	753.2685	704.5544	561.4605	390.0832	217.9657	110.9228	72.2597	(83)
Total gains	595.9304	684.3412	810.5153	985.5421	1137.7693	1158.3731	1093.8384	953.7958	797.1516	651.6708	577.2102	567.0403	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.8203	71.0537	71.2887	72.4871	72.7316	73.9794	73.9794	74.2341	73.4752	72.7316	72.2442	71.7632	
alpha	5.7214	5.7369	5.7526	5.8325	5.8488	5.9320	5.9320	5.9489	5.8983	5.8488	5.8163	5.7842	
util living area	0.9495	0.9033	0.7864	0.5758	0.3884	0.2587	0.1884	0.2251	0.4070	0.7170	0.9072	0.9584	(86)
MIT	20.4430	20.6297	20.8505	20.9756	20.9976	20.9998	21.0000	20.9999	20.9978	20.9371	20.6818	20.4051	(87)
Th 2	20.2807	20.2829	20.2851	20.2961	20.2983	20.3094	20.3094	20.3116	20.3050	20.2983	20.2939	20.2895	(88)
util rest of house	0.9400	0.8877	0.7604	0.5448	0.3594	0.2308	0.1588	0.1914	0.3664	0.6785	0.8895	0.9504	(89)
MIT 2	19.6501	19.8768	20.1321	20.2738	20.2964	20.3093	20.3094	20.3116	20.3035	20.2415	19.9531	19.6111	(90)
Living area fraction										fLA = Living area / (4) =		0.3699	(91)
MIT	19.9434	20.1553	20.3979	20.5334	20.5558	20.5647	20.5649	20.5662	20.5604	20.4988	20.2227	19.9048	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9434	20.1553	20.3979	20.5334	20.5558	20.5647	20.5649	20.5662	20.5604	20.4988	20.2227	19.9048	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9350	0.8847	0.7647	0.5553	0.3701	0.2411	0.1698	0.2039	0.3814	0.6898	0.8875	0.9454	(94)
Useful gains	557.2083	605.4138	619.7693	547.3032	421.0875	279.3214	185.6954	194.4496	304.0092	449.5203	512.2933	536.1066	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	765.3659	743.9254	675.4971	556.0856	421.8901	279.3673	185.6996	194.4617	304.6569	471.5806	629.3813	758.2722	(97)
Space heating kWh	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(98a)
Space heating requirement - total per year (kWh/year)												562.3385	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												562.3385	
Space heating per m2										(98c) / (4) =		8.8335	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.0817	10.0092	11.0817	10.7242	11.0817	10.7242	11.0817	11.0817	10.7242	11.0817	10.7242	11.0817	(231)
Lighting	18.3449	14.7170	13.2510	9.7083	7.4989	6.1267	6.8408	8.8919	11.5497	15.1538	17.1162	18.8548	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.3302	-24.3862	-39.3596	-49.2100	-57.7415	-55.5822	-54.6983	-49.3462	-40.2733	-29.5092	-17.6479	-12.9166	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.7432	-6.5971	-15.2405	-26.0425	-36.6010	-37.6280	-37.0950	-30.0206	-20.4973	-10.6316	-3.9607	-2.0877	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	562.3385	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2429.0422	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	130.4775	(230a)
Total electricity for the above, kWh/year	130.4775	(231)
Electricity for lighting (calculated in Appendix L)	148.0540	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-675.1465	(233)
Wind generation	0.0000	(234)

Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2594.7657	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	562.3385	16.4900	92.7296	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	16.4900	400.5491	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	130.4775	16.4900	21.5157	(249)
Energy for lighting	148.0540	16.4900	24.4141	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.0013	16.4900	-73.5456	
PV Unit electricity exported	-229.1452	5.5900	-12.8092	
Total			-86.3548	(252)
Total energy cost			452.8537	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.5003	(257)
SAP value	75.6794	
SAP rating (Section 12)	76	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	562.3385	0.1589	89.3676	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2429.0422	0.1413	343.1917	(264)
Space and water heating			432.5592	(265)
Pumps, fans and electric keep-hot	130.4775	0.1387	18.0988	(267)
Energy for lighting	148.0540	0.1443	21.3688	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.0013	0.1324	-59.0465	
PV Unit electricity exported	-229.1452	0.1229	-28.1599	
Total			-87.2065	(269)
Total CO2, kg/year			384.8203	(272)
CO2 emissions per m2			6.0400	(273)
EI value			95.2544	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.6600 (1b)	x	2.4000 (2b)	=	152.7840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 63.6600						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	152.7840	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			21.8000	1.2357	26.9392			(27)
External Wall 1	42.8700	21.8000	21.0700	0.1400	2.9498	14.0000	294.9800	(29a)
Total net area of external elements Aum(A, m2)			42.8700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.8890			(33)
Party Wall 1			37.5300	0.0000	0.0000	20.0000	750.6000	(32)
Wall to corridor			6.6800	0.0000	0.0000	20.0000	133.6000	(32)
Party Floor 1			63.6600			80.0000	5092.8000	(32d)
Party Ceiling 1			63.6600			80.0000	5092.8000	(32b)
Internal Wall 1			123.2200			9.0000	1108.9800	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12473.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 195.9434 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	9.3800	0.0500	0.4690
E4 Jamb	27.8400	0.0500	1.3920
E7 Party floor between dwellings (in blocks of flats)	15.8700	0.0700	1.1109
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3700	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.7819 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 33.6709 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.4155	15.4155	15.0941	14.1298	13.9691	13.3263	13.0049	13.0049	13.6477	14.4513	14.7727	14.6120	(38)
Heat transfer coeff	49.0864	49.0864	48.7650	47.8007	47.6400	46.9972	46.6757	46.6757	47.3186	48.1221	48.4435	48.2828	(39)
Average = Sum(39)m / 12 =												47.9078	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7711	0.7711	0.7660	0.7509	0.7484	0.7383	0.7332	0.7332	0.7433	0.7559	0.7610	0.7584	(40)
HLP (average)												0.7526	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0830 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	81.3240	80.1018	78.3209	74.9135	72.3989	69.5946	68.0007	69.7681	71.7056	74.7165	78.1971	81.0124	(42a)
Hot water usage for baths	25.5574	25.1778	24.6433	23.6578	22.9198	22.1016	21.6596	22.1903	22.7682	23.6438	24.6497	25.4710	(42b)
Hot water usage for other uses	35.9620	34.6543	33.3466	32.0389	30.7312	29.4235	29.4235	30.7312	32.0389	33.3466	34.6543	35.9620	(42c)
Average daily hot water use (litres/day)												131.3665	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	142.8434	139.9340	136.3109	130.6102	126.0499	121.1197	119.0838	122.6897	126.5127	131.7069	137.5011	142.4454	(44)
Energy conte	226.2290	199.2641	209.5047	178.7988	169.6874	148.9308	144.0215	151.9154	156.0028	178.7250	195.8955	223.0351	(45)
Energy content (annual)										Total = Sum(45)m =		2182.0102	
Distribution loss (46)m = 0.15 x (45)m	33.9344	29.8896	31.4257	26.8198	25.4531	22.3396	21.6032	22.7873	23.4004	26.8088	29.3843	33.4553	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
									Total per year (kWh/year) = Sum(64)m =			2429.0422	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	92.0058	81.4156	86.4450	75.6938	73.2057	65.7627	64.6718	67.2965	68.1141	76.2107	81.3784	90.9438	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	20.9586	18.6152	15.1389	11.4611	8.5673	7.2329	7.8154	10.1588	13.6351	17.3128	20.2066	21.5411	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	271.7527	274.5726	267.4664	252.3383	233.2416	215.2935	203.3031	200.4831	207.5893	222.7175	241.8141	259.7622	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	(71)

Water heating gains (Table 5)

	123.6637	121.1542	116.1895	105.1303	98.3948	91.3371	86.9244	90.4523	94.6030	102.4338	113.0256	122.2363	(72)

Total internal gains

	507.6160	505.5831	490.0359	460.1707	431.4448	405.1046	389.2840	392.3353	407.0684	433.7051	466.2874	494.7806	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1100	9.5462	0.6300	0.8270	0.7700	7.2726	(74)
Northeast	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(75)
Northwest	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(81)

Solar gains	78.5852	169.1438	316.2472	546.8143	731.2676	760.0483	718.8368	554.5515	381.6735	204.7435	101.3144	65.8401	(83)
Total gains	586.2012	674.7269	806.2830	1006.9851	1162.7125	1165.1528	1108.1208	946.8868	788.7419	638.4486	567.6018	560.6207	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.5885	70.5885	71.0537	72.4871	72.7316	73.7264	74.2341	74.2341	73.2256	72.0029	71.5252	71.7632	
alpha	5.7059	5.7059	5.7369	5.8325	5.8488	5.9151	5.9489	5.9489	5.8817	5.8002	5.7683	5.7842	
util living area	0.9573	0.9201	0.8197	0.6065	0.4204	0.3144	0.2569	0.3054	0.4881	0.7768	0.9246	0.9649	(86)
MIT	20.3836	20.5593	20.8002	20.9657	20.9959	20.9994	20.9999	20.9996	20.9932	20.8936	20.6163	20.3459	(87)
Th 2	20.2785	20.2785	20.2829	20.2961	20.2983	20.3072	20.3116	20.3116	20.3027	20.2917	20.2873	20.2895	(88)
util rest of house	0.9492	0.9069	0.7967	0.5771	0.3923	0.2865	0.2279	0.2716	0.4478	0.7427	0.9098	0.9582	(89)
MIT 2	19.5748	19.7882	20.0732	20.2636	20.2949	20.3067	20.3115	20.3114	20.2976	20.1904	19.8693	19.5372	(90)
Living area fraction									fLA = Living area / (4) =			0.3699	(91)
MIT	19.8740	20.0735	20.3421	20.5233	20.5543	20.5630	20.5662	20.5660	20.5549	20.4505	20.1456	19.8364	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8740	20.0735	20.3421	20.5233	20.5543	20.5630	20.5662	20.5660	20.5549	20.4505	20.1456	19.8364	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9440	0.9027	0.7987	0.5867	0.4026	0.2968	0.2386	0.2841	0.4625	0.7507	0.9065	0.9532	(94)
Useful gains	553.3976	609.0788	643.9471	590.8262	468.0629	345.8541	264.4318	269.0226	364.7623	479.2565	514.5178	534.3769	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	784.1055	774.2617	718.8998	603.4044	469.4566	346.0392	264.4719	269.1309	366.9520	517.3378	656.1978	779.1096	(97)
Space heating kWh	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(98a)
Space heating requirement - total per year (kWh/year)												660.9309	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												660.9309	
Space heating per m2											(98c) / (4) =	10.3822	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
Efficiency of water heater												100.0000	(216)

(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.0817	10.0092	11.0817	10.7242	11.0817	10.7242	11.0817	11.0817	10.7242	11.0817	10.7242	11.0817	(231)
Lighting	18.3449	14.7170	13.2510	9.7083	7.4989	6.1267	6.8408	8.8919	11.5497	15.1538	17.1162	18.8548	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-13.8915	-23.5305	-39.5288	-51.3707	-59.7978	-56.3926	-55.9689	-49.3612	-40.0071	-28.3817	-16.4413	-11.9422	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.3070	-6.0873	-15.0525	-27.9982	-39.0374	-38.6728	-38.7444	-30.0375	-20.2557	-9.7595	-3.4566	-1.8147	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	660.9309	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2429.0422	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	130.4775	(230a)
Total electricity for the above, kWh/year	130.4775	(231)
Electricity for lighting (calculated in Appendix L)	148.0540	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-679.8382	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2688.6664	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	660.9309	25.1600	166.2902	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	25.1600	611.1470	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	130.4775	25.1600	32.8281	(249)
Energy for lighting	148.0540	25.1600	37.2504	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.6146	25.1600	-112.3682	
PV Unit electricity exported	-233.2236	5.8100	-13.5503	
Total			-125.9185	(252)
Total energy cost			721.5972	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	660.9309	0.1583	104.6387	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2429.0422	0.1413	343.1917	(264)
Space and water heating			447.8304	(265)
Pumps, fans and electric keep-hot	130.4775	0.1387	18.0988	(267)
Energy for lighting	148.0540	0.1443	21.3688	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.6146	0.1321	-58.9946	
PV Unit electricity exported	-233.2236	0.1224	-28.5364	
Total			-87.5310	(269)
Total CO2, kg/year			399.7670	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	660.9309	1.5860	1048.2442	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	1.5224	3698.0874	(278)
Space and water heating			4746.3316	(279)
Pumps, fans and electric keep-hot	130.4775	1.5128	197.3864	(281)
Energy for lighting	148.0540	1.5338	227.0901	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.6146	1.4881	-664.5888	
PV Unit electricity exported	-233.2236	0.4490	-104.7247	
Total			-769.3135	(283)
Total Primary energy kWh/year			4401.4946	(286)

SAP 10 EPC IMPROVEMENTS

Unit 293 L01_Copy

Current energy efficiency rating: C 76
Current environmental impact rating: A 95

N Solar water heating	Not applicable
U Solar photovoltaic panels	Not applicable
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 76
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£848	£848	£0
Space heating	£199	£199	£0
Water heating	£611	£611	£0
Lighting	£37	£37	£0
Generated (PV)	-£126	-£126	£0
Total cost of fuels	£722	£722	£0
Total cost of uses	£721	£721	£0
Delivered energy	42 kWh/m²	42 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	69 kWh/m²	69 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.6600 (1b)	x	2.4000 (2b)	=	152.7840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.6600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	152.7840	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			21.8000	1.2357	26.9392			(27)
External Wall 1	42.8700	21.8000	21.0700	0.1400	2.9498	14.0000	294.9800	(29a)
Total net area of external elements Aum(A, m2)			42.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.8890			(33)
Party Wall 1			37.5300	0.0000	0.0000	20.0000	750.6000	(32)
Wall to corridor			6.6800	0.0000	0.0000	20.0000	133.6000	(32)
Party Floor 1			63.6600			80.0000	5092.8000	(32d)
Party Ceiling 1			63.6600			80.0000	5092.8000	(32b)
Internal Wall 1			123.2200			9.0000	1108.9800	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12473.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 195.9434 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	9.3800	0.0500	0.4690
E4 Jamb	27.8400	0.0500	1.3920
E7 Party floor between dwellings (in blocks of flats)	15.8700	0.0700	1.1109
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3700	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.7819 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 33.6709 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.2548	15.0941	14.9334	14.1298	13.9691	13.1656	13.1656	13.0049	13.4870	13.9691	14.2906	14.6120	(38)
Heat transfer coeff	48.9257	48.7650	48.6043	47.8007	47.6400	46.8365	46.8365	46.6757	47.1579	47.6400	47.9614	48.2828	(39)

Average = Sum(39)m / 12 = 47.7605

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7685	0.7660	0.7635	0.7509	0.7484	0.7357	0.7357	0.7332	0.7408	0.7484	0.7534	0.7584	(40)
HLP (average)												0.7502	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0830 (42)
Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
81.3240	80.1018	78.3209	74.9135	72.3989	69.5946	68.0007	69.7681	71.7056	74.7165	78.1971	81.0124	(42a)

Hot water usage for baths

25.5574	25.1778	24.6433	23.6578	22.9198	22.1016	21.6596	22.1903	22.7682	23.6438	24.6497	25.4710	(42b)

Hot water usage for other uses

35.9620	34.6543	33.3466	32.0389	30.7312	29.4235	29.4235	30.7312	32.0389	33.3466	34.6543	35.9620	(42c)

Average daily hot water use (litres/day) 131.3665 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	142.8434	139.9340	136.3109	130.6102	126.0499	121.1197	119.0838	122.6897	126.5127	131.7069	137.5011	142.4454	(44)
Energy conte	226.2290	199.2641	209.5047	178.7988	169.6874	148.9308	144.0215	151.9154	156.0028	178.7250	195.8955	223.0351	(45)
Energy content (annual)										Total = Sum(45)m =		2182.0102	
Distribution loss (46)m = 0.15 x (45)m	33.9344	29.8896	31.4257	26.8198	25.4531	22.3396	21.6032	22.7873	23.4004	26.8088	29.3843	33.4553	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
										Total per year (kWh/year) = Sum(64)m =		2429.0422	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	92.0058	81.4156	86.4450	75.6938	73.2057	65.7627	64.6718	67.2965	68.1141	76.2107	81.3784	90.9438	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.9586	18.6152	15.1389	11.4611	8.5673	7.2329	7.8154	10.1588	13.6351	17.3128	20.2066	21.5411	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	271.7527	274.5726	267.4664	252.3383	233.2416	215.2935	203.3031	200.4831	207.5893	222.7175	241.8141	259.7622	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	(71)
Water heating gains (Table 5)	123.6637	121.1542	116.1895	105.1303	98.3948	91.3371	86.9244	90.4523	94.6030	102.4338	113.0256	122.2363	(72)

Total internal gains

	507.6160	505.5831	490.0359	460.1707	431.4448	405.1046	389.2840	392.3353	407.0684	433.7051	466.2874	494.7806 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1100	10.6334	0.6300	0.8270	0.7700	8.1009	(74)
Northeast	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(75)
Northwest	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(81)

Solar gains	88.3144	178.7581	320.4794	525.3714	706.3245	753.2685	704.5544	561.4605	390.0832	217.9657	110.9228	72.2597 (83)
Total gains	595.9304	684.3412	810.5153	985.5421	1137.7693	1158.3731	1093.8384	953.7958	797.1516	651.6708	577.2102	567.0403 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.8203	71.0537	71.2887	72.4871	72.7316	73.9794	73.9794	74.2341	73.4752	72.7316	72.2442	71.7632	
alpha	5.7214	5.7369	5.7526	5.8325	5.8488	5.9320	5.9320	5.9489	5.8983	5.8488	5.8163	5.7842	
util living area	0.9495	0.9033	0.7864	0.5758	0.3884	0.2587	0.1884	0.2251	0.4070	0.7170	0.9072	0.9584	(86)
MIT	20.4430	20.6297	20.8505	20.9756	20.9976	20.9998	21.0000	20.9999	20.9978	20.9371	20.6818	20.4051	(87)
Th 2	20.2807	20.2829	20.2851	20.2961	20.2983	20.3094	20.3094	20.3116	20.3050	20.2983	20.2939	20.2895	(88)
util rest of house	0.9400	0.8877	0.7604	0.5448	0.3594	0.2308	0.1588	0.1914	0.3664	0.6785	0.8895	0.9504	(89)
MIT 2	19.6501	19.8768	20.1321	20.2738	20.2964	20.3093	20.3094	20.3116	20.3035	20.2415	19.9531	19.6111	(90)
Living area fraction									fLA = Living area / (4) =			0.3699	(91)
MIT	19.9434	20.1553	20.3979	20.5334	20.5558	20.5647	20.5649	20.5662	20.5604	20.4988	20.2227	19.9048	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9434	20.1553	20.3979	20.5334	20.5558	20.5647	20.5649	20.5662	20.5604	20.4988	20.2227	19.9048	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9350	0.8847	0.7647	0.5553	0.3701	0.2411	0.1698	0.2039	0.3814	0.6898	0.8875	0.9454	(94)
Useful gains	557.2083	605.4138	619.7693	547.3032	421.0875	279.3214	185.6954	194.4496	304.0092	449.5203	512.2933	536.1066	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	765.3659	743.9254	675.4971	556.0856	421.8901	279.3673	185.6996	194.4617	304.6569	471.5806	629.3813	758.2722	(97)
Space heating kWh	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(98a)
Space heating requirement - total per year (kWh/year)												562.3385	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												562.3385	
Space heating per m2											(98c) / (4) =	8.8335	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.0817	10.0092	11.0817	10.7242	11.0817	10.7242	11.0817	11.0817	10.7242	11.0817	10.7242	11.0817	(231)
Lighting	18.3449	14.7170	13.2510	9.7083	7.4989	6.1267	6.8408	8.8919	11.5497	15.1538	17.1162	18.8548	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.3302	-24.3862	-39.3596	-49.2100	-57.7415	-55.5822	-54.6983	-49.3462	-40.2733	-29.5092	-17.6479	-12.9166	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													

(233b)m	-2.7432	-6.5971	-15.2405	-26.0425	-36.6010	-37.6280	-37.0950	-30.0206	-20.4973	-10.6316	-3.9607	-2.0877	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	562.3385	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2429.0422	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	130.4775	(230a)
Total electricity for the above, kWh/year	130.4775	(231)
Electricity for lighting (calculated in Appendix L)	148.0540	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-675.1465	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2594.7657	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	562.3385	16.4900	92.7296	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	16.4900	400.5491	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	130.4775	16.4900	21.5157	(249)
Energy for lighting	148.0540	16.4900	24.4141	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.0013	16.4900	-73.5456	
PV Unit electricity exported	-229.1452	5.5900	-12.8092	
Total			-86.3548	(252)
Total energy cost			452.8537	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.5003	(257)
SAP value		75.6794	
SAP rating (Section 12)		76	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	562.3385	0.1589	89.3676	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2429.0422	0.1413	343.1917	(264)
Space and water heating			432.5592	(265)
Pumps, fans and electric keep-hot	130.4775	0.1387	18.0988	(267)
Energy for lighting	148.0540	0.1443	21.3688	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.0013	0.1324	-59.0465	
PV Unit electricity exported	-229.1452	0.1229	-28.1599	
Total			-87.2065	(269)
Total CO2, kg/year			384.8203	(272)
CO2 emissions per m2			6.0400	(273)
EI value			95.2544	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		63.6600 (1b)	x	2.4000 (2b)	=	152.7840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.6600						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	152.7840	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			21.8000	1.2357	26.9392			(27)
External Wall 1	42.8700	21.8000	21.0700	0.1400	2.9498	14.0000	294.9800	(29a)
Total net area of external elements Aum(A, m2)			42.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.8890			(33)
Party Wall 1			37.5300	0.0000	0.0000	20.0000	750.6000	(32)
Wall to corridor			6.6800	0.0000	0.0000	20.0000	133.6000	(32)
Party Floor 1			63.6600			80.0000	5092.8000	(32d)
Party Ceiling 1			63.6600			80.0000	5092.8000	(32b)
Internal Wall 1			123.2200			9.0000	1108.9800	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12473.7600	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	195.9434	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	9.3800	0.0500	0.4690
E4 Jamb	27.8400	0.0500	1.3920
E7 Party floor between dwellings (in blocks of flats)	15.8700	0.0700	1.1109
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3700	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	3.7819	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	33.6709	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.4155	15.4155	15.0941	14.1298	13.9691	13.3263	13.0049	13.0049	13.6477	14.4513	14.7727	14.6120	(38)
Heat transfer coeff	49.0864	49.0864	48.7650	47.8007	47.6400	46.9972	46.6757	46.6757	47.3186	48.1221	48.4435	48.2828	(39)
Average = Sum(39)m / 12 =												47.9078	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7711	0.7711	0.7660	0.7509	0.7484	0.7383	0.7332	0.7332	0.7433	0.7559	0.7610	0.7584	(40)
HLP (average)												0.7526	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0830	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
81.3240	80.1018	78.3209	74.9135	72.3989	69.5946	68.0007	69.7681	71.7056	74.7165	78.1971	81.0124	(42a)

Hot water usage for baths

25.5574	25.1778	24.6433	23.6578	22.9198	22.1016	21.6596	22.1903	22.7682	23.6438	24.6497	25.4710	(42b)

Hot water usage for other uses

35.9620	34.6543	33.3466	32.0389	30.7312	29.4235	29.4235	30.7312	32.0389	33.3466	34.6543	35.9620	(42c)

Average daily hot water use (litres/day)	131.3665	(43)

Daily hot water use

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
142.8434	139.9340	136.3109	130.6102	126.0499	121.1197	119.0838	122.6897	126.5127	131.7069	137.5011	142.4454	(44)
Energy conte 226.2290	199.2641	209.5047	178.7988	169.6874	148.9308	144.0215	151.9154	156.0028	178.7250	195.8955	223.0351	(45)
Energy content (annual)										Total = Sum(45)m =		2182.0102	

Distribution loss (46)m = 0.15 x (45)m

33.9344	29.8896	31.4257	26.8198	25.4531	22.3396	21.6032	22.7873	23.4004	26.8088	29.3843	33.4553	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

Total storage loss													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
											Total per year (kWh/year) = Sum(64)m =	2429.0422	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000	(64a)
Heat gains from water heating, kWh/month													
	92.0058	81.4156	86.4450	75.6938	73.2057	65.7627	64.6718	67.2965	68.1141	76.2107	81.3784	90.9438	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.9586	18.6152	15.1389	11.4611	8.5673	7.2329	7.8154	10.1588	13.6351	17.3128	20.2066	21.5411	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	271.7527	274.5726	267.4664	252.3383	233.2416	215.2935	203.3031	200.4831	207.5893	222.7175	241.8141	259.7622	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	(71)
Water heating gains (Table 5)													
	123.6637	121.1542	116.1895	105.1303	98.3948	91.3371	86.9244	90.4523	94.6030	102.4338	113.0256	122.2363	(72)
Total internal gains													
	507.6160	505.5831	490.0359	460.1707	431.4448	405.1046	389.2840	392.3353	407.0684	433.7051	466.2874	494.7806	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1100	9.5462	0.6300	0.8270	0.7700	7.2726	(74)
Northeast	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(75)
Northwest	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(81)

Solar gains	78.5852	169.1438	316.2472	546.8143	731.2676	760.0483	718.8368	554.5515	381.6735	204.7435	101.3144	65.8401	(83)
Total gains	586.2012	674.7269	806.2830	1006.9851	1162.7125	1165.1528	1108.1208	946.8868	788.7419	638.4486	567.6018	560.6207	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.5885	70.5885	71.0537	72.4871	72.7316	73.7264	74.2341	74.2341	73.2256	72.0029	71.5252	71.7632	
alpha	5.7059	5.7059	5.7369	5.8325	5.8488	5.9151	5.9489	5.9489	5.8817	5.8002	5.7683	5.7842	
util living area													
	0.9573	0.9201	0.8197	0.6065	0.4204	0.3144	0.2569	0.3054	0.4881	0.7768	0.9246	0.9649	(86)
MIT	20.3836	20.5593	20.8002	20.9657	20.9959	20.9994	20.9999	20.9996	20.9932	20.8936	20.6163	20.3459	(87)
Th 2	20.2785	20.2785	20.2829	20.2961	20.2983	20.3072	20.3116	20.3116	20.3027	20.2917	20.2873	20.2895	(88)
util rest of house													
	0.9492	0.9069	0.7967	0.5771	0.3923	0.2865	0.2279	0.2716	0.4478	0.7427	0.9098	0.9582	(89)
MIT 2	19.5748	19.7882	20.0732	20.2636	20.2949	20.3067	20.3115	20.3114	20.2976	20.1904	19.8693	19.5372	(90)
Living area fraction										fLA = Living area / (4) =		0.3699	(91)
MIT	19.8740	20.0735	20.3421	20.5233	20.5543	20.5630	20.5662	20.5660	20.5549	20.4505	20.1456	19.8364	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8740	20.0735	20.3421	20.5233	20.5543	20.5630	20.5662	20.5660	20.5549	20.4505	20.1456	19.8364	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9440	0.9027	0.7987	0.5867	0.4026	0.2968	0.2386	0.2841	0.4625	0.7507	0.9065	0.9532	(94)
Useful gains	553.3976	609.0788	643.9471	590.8262	468.0629	345.8541	264.4318	269.0226	364.7623	479.2565	514.5178	534.3769	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	784.1055	774.2617	718.8998	603.4044	469.4566	346.0392	264.4719	269.1309	366.9520	517.3378	656.1978	779.1096	(97)
Space heating kWh													
	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(98a)
Space heating requirement - total per year (kWh/year)												660.9309	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												660.9309	
Space heating per m2											(98c) / (4) =	10.3822	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.0817	10.0092	11.0817	10.7242	11.0817	10.7242	11.0817	11.0817	10.7242	11.0817	10.7242	11.0817	(231)
Lighting	18.3449	14.7170	13.2510	9.7083	7.4989	6.1267	6.8408	8.8919	11.5497	15.1538	17.1162	18.8548	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-13.8915	-23.5305	-39.5288	-51.3707	-59.7978	-56.3926	-55.9689	-49.3612	-40.0071	-28.3817	-16.4413	-11.9422	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.3070	-6.0873	-15.0525	-27.9982	-39.0374	-38.6728	-38.7444	-30.0375	-20.2557	-9.7595	-3.4566	-1.8147	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												660.9309	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2429.0422	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)													
mechanical ventilation fans (SFP = 0.7000)												130.4775	(230a)
Total electricity for the above, kWh/year												130.4775	(231)
Electricity for lighting (calculated in Appendix L)												148.0540	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-679.8382	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2688.6664	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	660.9309	25.1600	166.2902	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	25.1600	611.1470	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	130.4775	25.1600	32.8281	(249)
Energy for lighting	148.0540	25.1600	37.2504	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.6146	25.1600	-112.3682	
PV Unit electricity exported	-233.2236	5.8100	-13.5503	
Total			-125.9185	(252)
Total energy cost			721.5972	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	660.9309	0.1583	104.6387	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2429.0422	0.1413	343.1917	(264)
Space and water heating			447.8304	(265)
Pumps, fans and electric keep-hot	130.4775	0.1387	18.0988	(267)
Energy for lighting	148.0540	0.1443	21.3688	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.6146	0.1321	-58.9946	
PV Unit electricity exported	-233.2236	0.1224	-28.5364	
Total			-87.5310	(269)
Total CO2, kg/year			399.7670	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	660.9309	1.5860	1048.2442	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	1.5224	3698.0874	(278)
Space and water heating			4746.3316	(279)
Pumps, fans and electric keep-hot	130.4775	1.5128	197.3864	(281)
Energy for lighting	148.0540	1.5338	227.0901	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.6146	1.4881	-664.5888	
PV Unit electricity exported	-233.2236	0.4490	-104.7247	
Total			-769.3135	(283)
Total Primary energy kWh/year			4401.4946	(286)

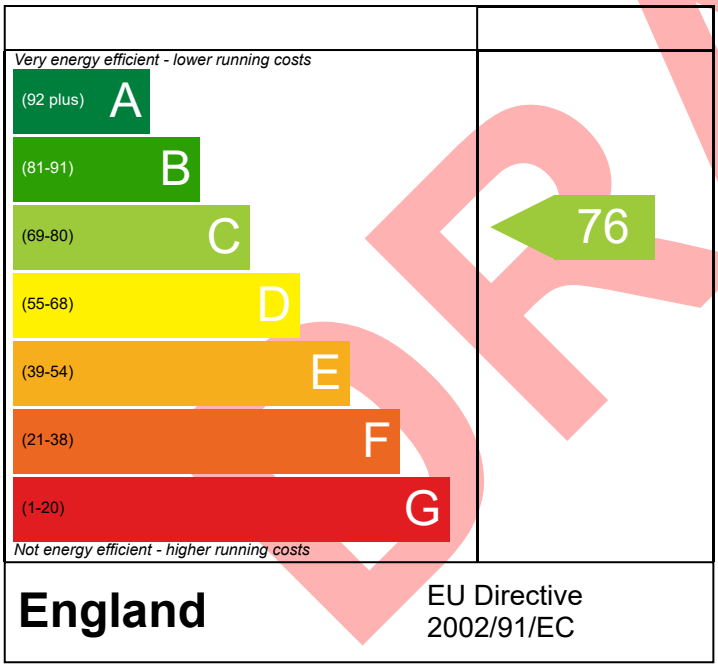
Predicted Energy Assessment

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	63.66 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

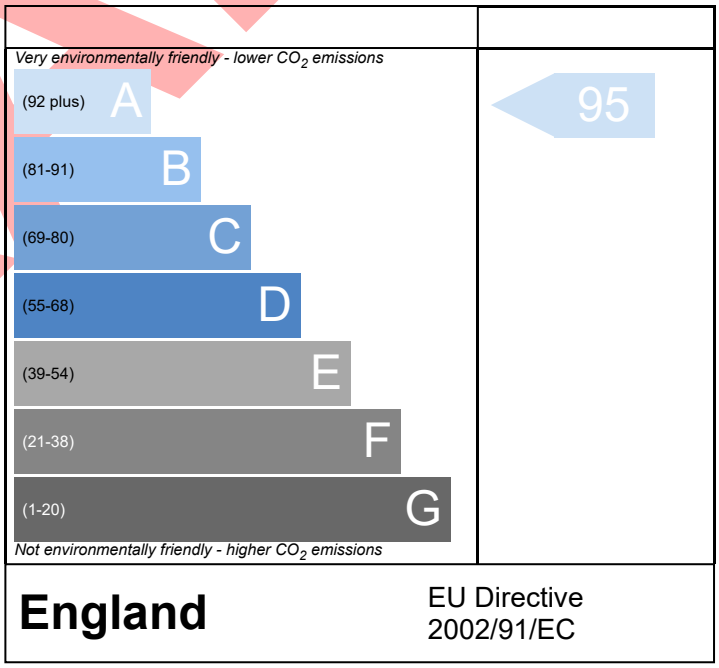
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:53

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	49 m^2
Site Reference	Unit 298 L01 _Copy	Plot Reference	Unit 298 L01_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.48 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	5.6 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*62.71 kWh$_{PE}$/m^2*	
Dwelling primary energy	62.89 kWh$_{PE}$/m^2	FAIL
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*12.1 kWh/m^2*	
Dwelling fabric energy efficiency	11.1 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	9.95	0.14 **(!)**
Party wall: Party Wall (1)	24.84	0 **(!)**
Party wall: Party Wall (2)	39.01	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	4.22	North East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.63 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 298 L01 _Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 298 L01_Copy	**Prop Type Ref**	Unit 298 L01
Property			

SAP Rating	80 C	**DER**	5.60	**TER**	11.48
Environmental	96 A	**% DER < TER**			51.22
CO_2 Emissions (t/year)	0.27	**DFEE**	11.14	**TFEE**	12.05
Compliance Check	See BREL	**% DFEE < TFEE**			7.57
% DPER < TPER	-0.28	**DPER**	62.89	**TPER**	62.71

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.8100	(1b)	x 2.4000	(2b) =	117.1440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.8100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		117.1440	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												72.0000	(23c)
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			4.2200	1.2357	5.2148			(27)
External Wall 1	14.1700	4.2200	9.9500	0.1400	1.3930	14.0000	139.3000	(29a)
Total net area of external elements Aum(A, m2)			14.1700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		6.6078			(33)
Party Wall 1			24.8400	0.0000	0.0000	20.0000	496.8000	(32)
Wall to corridor			39.0100	0.0000	0.0000	20.0000	780.2000	(32)
Party Floor 1			48.8100			80.0000	3904.8000	(32d)
Party Ceiling 1			48.8100			80.0000	3904.8000	(32b)
Internal Wall 1			72.6800			9.0000	654.1200	(32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		9880.0200	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							202.4179	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	1.8200	0.0500	0.0910

E4 Jamb	9.2800	0.0500	0.4640	
E7 Party floor between dwellings (in blocks of flats)	5.2500	0.0700	0.3675	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	20.8400	0.0000	0.0000	
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.2465 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 7.8543 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.1418	11.0295	10.9171	10.3554	10.2430	9.6813	9.6813	9.5689	9.9060	10.2430	10.4677	10.6924	(38)
Heat transfer coeff	18.9962	18.8838	18.7715	18.2097	18.0974	17.5356	17.5356	17.4233	17.7603	18.0974	18.3221	18.5468	(39)
Average = Sum(39)m / 12 =												18.1816	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.3892	0.3869	0.3846	0.3731	0.3708	0.3593	0.3593	0.3570	0.3639	0.3708	0.3754	0.3800	(40)
HLP (average)												0.3725	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6551 (42)
Hot water usage for mixer showers

71.4595	70.3856	68.8207	65.8266	63.6170	61.1529	59.7523	61.3053	63.0077	65.6534	68.7119	71.1857	(42a)

Hot water usage for baths

22.4723	22.1385	21.6685	20.8020	20.1531	19.4336	19.0450	19.5117	20.0198	20.7897	21.6741	22.3963	(42b)

Hot water usage for other uses

31.5802	30.4318	29.2834	28.1350	26.9867	25.8383	25.8383	26.9867	28.1350	29.2834	30.4318	31.5802	(42c)

Average daily hot water use (litres/day) 115.4278 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	125.5119	122.9558	119.7726	114.7636	110.7568	106.4248	104.6356	107.8037	111.1626	115.7265	120.8177	125.1621	(44)
Energy conte	198.7801	175.0875	184.0861	157.1056	149.0999	130.8617	126.5476	133.4834	137.0746	157.0398	172.1270	195.9736	(45)
Energy content (annual)											Total = Sum(45)m =	1917.2669	
Distribution loss (46)m = 0.15 x (45)m	29.8170	26.2631	27.6129	23.5658	22.3650	19.6293	18.9821	20.0225	20.5612	23.5560	25.8191	29.3960	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
										Total per year (kWh/year) = Sum(64)m =		2164.2989	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	82.8790	73.3769	77.9933	68.4808	66.3603	59.7547	58.8617	61.1679	61.8205	69.0004	73.4754	81.9459	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.0740	16.9413	13.7776	10.4305	7.7970	6.5825	7.1126	9.2453	12.4090	15.7561	18.3897	19.6041	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.1398	217.3723	211.7465	199.7699	184.6516	170.4425	160.9500	158.7175	164.3433	176.3199	191.4382	205.6473	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	(71)
Water heating gains (Table 5)	111.3965	109.1918	104.8296	95.1122	89.1940	82.9927	79.1152	82.2149	85.8618	92.7424	102.0492	110.1423	(72)
Total internal gains	425.2988	423.1939	410.0422	385.0011	361.3310	339.7061	326.8663	329.8661	342.3025	364.5068	391.5655	415.0821	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	4.2200	11.2829	0.6300	0.8270	0.7700	17.1915	(75)

Solar gains	17.1915	34.9938	63.0477	103.5425	139.1814	148.3821	138.8084	110.6597	76.8246	42.7652	21.6314	14.0395	(83)
Total gains	442.4903	458.1877	473.0899	488.5436	500.5124	488.0882	465.6747	440.5258	419.1272	407.2721	413.1969	429.1215	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	144.4740	145.3335	146.2034	150.7135	151.6492	156.5071	156.5071	157.5163	154.5271	151.6492	149.7894	147.9747	
alpha	10.6316	10.6889	10.7469	11.0476	11.1099	11.4338	11.4338	11.5011	11.3018	11.1099	10.9860	10.8650	
util living area													
	0.7109	0.6607	0.5747	0.4510	0.3363	0.2299	0.1657	0.1819	0.2924	0.4621	0.6152	0.7198	(86)
MIT	20.9918	20.9960	20.9991	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9999	20.9985	20.9917	(87)
Th 2	20.6234	20.6256	20.6277	20.6385	20.6407	20.6515	20.6515	20.6537	20.6472	20.6407	20.6364	20.6321	(88)
util rest of house													
	0.6959	0.6459	0.5601	0.4375	0.3233	0.2174	0.1526	0.1682	0.2774	0.4461	0.5993	0.7051	(89)
MIT 2	20.6149	20.6215	20.6268	20.6385	20.6407	20.6515	20.6515	20.6537	20.6472	20.6406	20.6349	20.6234	(90)
Living area fraction										fLA = Living area / (4) =		0.5530	(91)
MIT	20.8233	20.8286	20.8327	20.8384	20.8394	20.8442	20.8442	20.8452	20.8423	20.8393	20.8360	20.8270	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.8233	20.8286	20.8327	20.8384	20.8394	20.8442	20.8442	20.8452	20.8423	20.8393	20.8360	20.8270	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7039	0.6540	0.5681	0.4450	0.3305	0.2243	0.1598	0.1758	0.2857	0.4550	0.6081	0.7129	(94)
Useful gains	311.4658	299.6348	268.7750	217.3782	165.3980	109.4960	74.4247	77.4494	119.7448	185.2886	251.2461	305.9341	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	313.8790	300.7928	269.0448	217.3940	165.3985	109.4960	74.4247	77.4494	119.7449	185.3046	251.6712	308.3773	(97)
Space heating kWh	1.7954	0.7782	0.2007	0.0113	0.0004	0.0000	0.0000	0.0000	0.0000	0.0119	0.3061	1.8178	(98a)
Space heating requirement - total per year (kWh/year)												4.9218	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	1.7954	0.7782	0.2007	0.0113	0.0004	0.0000	0.0000	0.0000	0.0000	0.0119	0.3061	1.8178	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4.9218	
Space heating per m2											(98c) / (4) =	0.1008	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1.7954	0.7782	0.2007	0.0113	0.0004	0.0000	0.0000	0.0000	0.0000	0.0119	0.3061	1.8178	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	1.7954	0.7782	0.2007	0.0113	0.0004	0.0000	0.0000	0.0000	0.0000	0.0119	0.3061	1.8178	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.4966	7.6744	8.4966	8.2225	8.4966	8.2225	8.4966	8.4966	8.2225	8.4966	8.2225	8.4966	(231)
Lighting	16.6953	13.3936	12.0595	8.8353	6.8246	5.5758	6.2257	8.0923	10.5112	13.7912	15.5771	17.1594	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.6057	-18.5259	-30.3122	-38.4756	-45.4210	-43.7997	-43.1129	-38.8271	-31.5899	-22.8900	-13.4515	-9.7746	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.2799	-5.2783	-11.6366	-19.3403	-27.0617	-27.8130	-27.4113	-22.1498	-15.0998	-7.9499	-3.1503	-1.7531	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4.9218	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2164.2989	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)													
mechanical ventilation fans (SFP = 0.7000)												100.0410	(230a)
Total electricity for the above, kWh/year												100.0410	(231)
Electricity for lighting (calculated in Appendix L)												134.7410	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-518.7101	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)

Appendix Q - special features

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1885.2926	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4.9218	16.4900	0.8116	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	16.4900	356.8929	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	100.0410	16.4900	16.4968	(249)
Energy for lighting	134.7410	16.4900	22.2188	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.7861	16.4900	-57.3499	
PV Unit electricity exported	-170.9240	5.5900	-9.5546	
Total			-66.9046	(252)
Total energy cost			329.5155	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2645	(257)
SAP value	79.5020	
SAP rating (Section 12)	80	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4.9218	0.1613	0.7937	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2164.2989	0.1413	305.7097	(264)
Space and water heating			306.5034	(265)
Pumps, fans and electric keep-hot	100.0410	0.1387	13.8769	(267)
Energy for lighting	134.7410	0.1443	19.4473	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.7861	0.1322	-45.9728	
PV Unit electricity exported	-170.9240	0.1235	-21.1019	
Total			-67.0747	(269)
Total CO2, kg/year			272.7529	(272)
CO2 emissions per m2			5.5900	(273)
EI value			96.1039	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.8100	(1b)	x 2.4000	(2b) =	117.1440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.8100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		117.1440	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 = 0.0000	(6a)
Number of open flues	0 * 20 = 0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000	(6d)
Number of flues attached to other heater	0 * 35 = 0.0000	(6e)
Number of blocked chimneys	0 * 20 = 0.0000	(6f)
Number of intermittent extract fans	0 * 10 = 0.0000	(7a)
Number of passive vents	0 * 10 = 0.0000	(7b)
Number of flueless gas fires	0 * 40 = 0.0000	(7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000	(8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	3.0000	(17)
Infiltration rate	0.1500	(18)
Number of sides sheltered	3	(19)
Shelter factor (20) = 1 - [0.075 x (19)] =	0.7750	(20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			4.2200	1.2357	5.2148			(27)
External Wall 1	14.1700	4.2200	9.9500	0.1400	1.3930	14.0000	139.3000	(29a)
Total net area of external elements Aum(A, m2)			14.1700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	6.6078			(33)
Party Wall 1			24.8400	0.0000	0.0000	20.0000	496.8000	(32)
Wall to corridor			39.0100	0.0000	0.0000	20.0000	780.2000	(32)
Party Floor 1			48.8100			80.0000	3904.8000	(32d)
Party Ceiling 1			48.8100			80.0000	3904.8000	(32b)
Internal Wall 1			72.6800			9.0000	654.1200	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9880.0200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 202.4179 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	1.8200	0.0500	0.0910
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.2500	0.0700	0.3675
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	20.8400	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.2465 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 7.8543 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.2542	11.2542	11.0295	10.3554	10.2430	9.7936	9.5689	9.5689	10.0183	10.5801	10.8048	10.6924	(38)
Heat transfer coeff	19.1085	19.1085	18.8838	18.2097	18.0974	17.6480	17.4233	17.4233	17.8727	18.4344	18.6591	18.5468	(39)

Average = Sum(39)m / 12 = 18.2846

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.3915	0.3915	0.3869	0.3731	0.3708	0.3616	0.3570	0.3570	0.3662	0.3777	0.3823	0.3800	(40)
HLP (average)												0.3746	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6551 (42)
Hot water usage for mixer showers

71.4595	70.3856	68.8207	65.8266	63.6170	61.1529	59.7523	61.3053	63.0077	65.6534	68.7119	71.1857	(42a)

Hot water usage for baths

22.4723	22.1385	21.6685	20.8020	20.1531	19.4336	19.0450	19.5117	20.0198	20.7897	21.6741	22.3963	(42b)

Hot water usage for other uses

31.5802	30.4318	29.2834	28.1350	26.9867	25.8383	25.8383	26.9867	28.1350	29.2834	30.4318	31.5802	(42c)

Average daily hot water use (litres/day) 115.4278 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	125.5119	122.9558	119.7726	114.7636	110.7568	106.4248	104.6356	107.8037	111.1626	115.7265	120.8177	125.1621	(44)
Energy conte	198.7801	175.0875	184.0861	157.1056	149.0999	130.8617	126.5476	133.4834	137.0746	157.0398	172.1270	195.9736	(45)

Energy content (annual) Total = Sum(45)m = 1917.2669
Distribution loss (46)m = 0.15 x (45)m

29.8170	26.2631	27.6129	23.5658	22.3650	19.6293	18.9821	20.0225	20.5612	23.5560	25.8191	29.3960	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h												
219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)

Total per year (kWh/year) = Sum(64)m = 2164.2989 (64)
Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month

82.8790	73.3769	77.9933	68.4808	66.3603	59.7547	58.8617	61.1679	61.8205	69.0004	73.4754	81.9459	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.0740	16.9413	13.7776	10.4305	7.7970	6.5825	7.1126	9.2453	12.4090	15.7561	18.3897	19.6041	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	215.1398	217.3723	211.7465	199.7699	184.6516	170.4425	160.9500	158.7175	164.3433	176.3199	191.4382	205.6473	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	(71)
Water heating gains (Table 5)													
	111.3965	109.1918	104.8296	95.1122	89.1940	82.9927	79.1152	82.2149	85.8618	92.7424	102.0492	110.1423	(72)
Total internal gains													
	425.2988	423.1939	410.0422	385.0011	361.3310	339.7061	326.8663	329.8661	342.3025	364.5068	391.5655	415.0821	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	4.2200	10.0309	0.6300	0.8270	0.7700	15.2838	(75)

Solar gains	15.2838	33.0890	62.1941	107.7628	144.1061	149.7318	141.6342	109.2990	75.1529	40.1487	19.7409	12.7801	(83)
Total gains	440.5826	456.2829	472.2363	492.7639	505.4371	489.4379	468.5005	439.1651	417.4554	404.6555	411.3064	427.8622	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	143.6246	143.6246	145.3335	150.7135	151.6492	155.5108	157.5163	157.5163	153.5557	148.8765	147.0837	147.9747	
alpha	10.5750	10.5750	10.6889	11.0476	11.1099	11.3674	11.5011	11.5011	11.2370	10.9251	10.8056	10.8650	
util living area													
	0.7333	0.6945	0.6145	0.4840	0.3688	0.2812	0.2269	0.2460	0.3511	0.5146	0.6510	0.7414	(86)
MIT	20.9886	20.9931	20.9981	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9998	20.9971	20.9887	(87)
Th 2	20.6213	20.6213	20.6256	20.6385	20.6407	20.6493	20.6537	20.6537	20.6450	20.6342	20.6299	20.6321	(88)
util rest of house													
	0.7184	0.6796	0.5998	0.4707	0.3559	0.2686	0.2140	0.2322	0.3359	0.4980	0.6347	0.7270	(89)
MIT 2	20.6094	20.6142	20.6236	20.6384	20.6407	20.6493	20.6537	20.6537	20.6450	20.6340	20.6270	20.6202	(90)
Living area fraction										fLA = Living area / (4) =		0.5530	(91)
MIT	20.8191	20.8237	20.8307	20.8383	20.8394	20.8432	20.8452	20.8452	20.8413	20.8363	20.8317	20.8240	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.8191	20.8237	20.8307	20.8383	20.8394	20.8432	20.8452	20.8452	20.8413	20.8363	20.8317	20.8240	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7262	0.6876	0.6079	0.4781	0.3630	0.2756	0.2211	0.2398	0.3443	0.5072	0.6436	0.7346	(94)
Useful gains	319.9441	313.7342	287.0503	235.5670	183.4943	134.8876	103.5843	105.3267	143.7189	205.2295	264.7127	314.2864	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	323.2978	315.7439	287.6131	235.6024	183.4958	134.8876	103.5843	105.3267	143.7195	205.2905	265.5499	317.5946	(97)
Space heating kWh													
	2.4952	1.3505	0.4188	0.0255	0.0011	0.0000	0.0000	0.0000	0.0000	0.0454	0.6028	2.4613	(98a)
Space heating requirement - total per year (kWh/year)												7.4006	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	2.4952	1.3505	0.4188	0.0255	0.0011	0.0000	0.0000	0.0000	0.0000	0.0454	0.6028	2.4613	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7.4006	
Space heating per m2										(98c) / (4) =		0.1516	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	2.4952	1.3505	0.4188	0.0255	0.0011	0.0000	0.0000	0.0000	0.0000	0.0454	0.6028	2.4613	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	2.4952	1.3505	0.4188	0.0255	0.0011	0.0000	0.0000	0.0000	0.0000	0.0454	0.6028	2.4613	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(219)
Space cooling fuel requirement													

(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.4966	7.6744	8.4966	8.2225	8.4966	8.2225	8.4966	8.4966	8.2225	8.4966	8.2225	8.4966	(231)
Lighting	16.6953	13.3936	12.0595	8.8353	6.8246	5.5758	6.2257	8.0923	10.5112	13.7912	15.5771	17.1594	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.5053	-17.8142	-30.3063	-40.1273	-47.0520	-44.4497	-44.1326	-38.8391	-31.3783	-21.9178	-12.4956	-9.0275	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.9399	-4.9409	-11.6282	-20.8513	-28.8824	-28.5884	-28.6349	-22.1624	-14.9212	-7.3858	-2.7918	-1.5419	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	7.4006	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2164.2989	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	100.0410	(230a)
Total electricity for the above, kWh/year	100.0410	(231)
Electricity for lighting (calculated in Appendix L)	134.7410	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-522.3147	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1884.1667	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	7.4006	25.1600	1.8620	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	25.1600	544.5376	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	100.0410	25.1600	25.1703	(249)
Energy for lighting	134.7410	25.1600	33.9008	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-348.0458	25.1600	-87.5683	
PV Unit electricity exported	-174.2689	5.8100	-10.1250	
Total			-97.6934	(252)
Total energy cost			507.7774	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	7.4006	0.1607	1.1890	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2164.2989	0.1413	305.7097	(264)
Space and water heating			306.8988	(265)
Pumps, fans and electric keep-hot	100.0410	0.1387	13.8769	(267)
Energy for lighting	134.7410	0.1443	19.4473	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-348.0458	0.1319	-45.8985	
PV Unit electricity exported	-174.2689	0.1230	-21.4320	
Total			-67.3305	(269)
Total CO2, kg/year			272.8924	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	7.4006	1.5946	11.8013	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	1.5223	3294.7406	(278)
Space and water heating			3306.5418	(279)
Pumps, fans and electric keep-hot	100.0410	1.5128	151.3420	(281)
Energy for lighting	134.7410	1.5338	206.6703	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-348.0458	1.4872	-517.6275	
PV Unit electricity exported	-174.2689	0.4513	-78.6547	
Total			-596.2822	(283)
Total Primary energy kWh/year			3068.2718	(286)

SAP 10 EPC IMPROVEMENTS

Unit 298 L01_Copy

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N Solar water heating — Not applicable
U Solar photovoltaic panels — Not applicable
V2 Wind turbine — Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 80
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£605	£605	£0
Space heating	£27	£27	£0
Water heating	£545	£545	£0
Lighting	£34	£34	£0
Generated (PV)	-£98	-£98	£0
Total cost of fuels	£507	£507	£0
Total cost of uses	£508	£508	£0
Delivered energy	39 kWh/m²	39 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	63 kWh/m²	63 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.8100 (1b)	x	2.4000 (2b)	=	117.1440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.8100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	117.1440	(5)

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2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			4.2200	1.2357	5.2148			(27)
External Wall 1	14.1700	4.2200	9.9500	0.1400	1.3930	14.0000	139.3000	(29a)
Total net area of external elements Aum(A, m2)			14.1700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		6.6078			(33)
Party Wall 1			24.8400	0.0000	0.0000	20.0000	496.8000	(32)
Wall to corridor			39.0100	0.0000	0.0000	20.0000	780.2000	(32)
Party Floor 1			48.8100			80.0000	3904.8000	(32d)
Party Ceiling 1			48.8100			80.0000	3904.8000	(32b)
Internal Wall 1			72.6800			9.0000	654.1200	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9880.0200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 202.4179 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	1.8200	0.0500	0.0910
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.2500	0.0700	0.3675
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	20.8400	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.2465 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 7.8543 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.1418	11.0295	10.9171	10.3554	10.2430	9.6813	9.6813	9.5689	9.9060	10.2430	10.4677	10.6924	(38)
Heat transfer coeff	18.9962	18.8838	18.7715	18.2097	18.0974	17.5356	17.5356	17.4233	17.7603	18.0974	18.3221	18.5468	(39)
Average = Sum(39)m / 12 =												18.1816	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.3892	0.3869	0.3846	0.3731	0.3708	0.3593	0.3593	0.3570	0.3639	0.3708	0.3754	0.3800	(40)
HLP (average)												0.3725	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6551 (42)
Hot water usage for mixer showers

71.4595	70.3856	68.8207	65.8266	63.6170	61.1529	59.7523	61.3053	63.0077	65.6534	68.7119	71.1857	(42a)

Hot water usage for baths

22.4723	22.1385	21.6685	20.8020	20.1531	19.4336	19.0450	19.5117	20.0198	20.7897	21.6741	22.3963	(42b)

Hot water usage for other uses

31.5802	30.4318	29.2834	28.1350	26.9867	25.8383	25.8383	26.9867	28.1350	29.2834	30.4318	31.5802	(42c)

Average daily hot water use (litres/day) 115.4278 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	125.5119	122.9558	119.7726	114.7636	110.7568	106.4248	104.6356	107.8037	111.1626	115.7265	120.8177	125.1621	(44)
Energy conte	198.7801	175.0875	184.0861	157.1056	149.0999	130.8617	126.5476	133.4834	137.0746	157.0398	172.1270	195.9736	(45)
Energy content (annual)										Total = Sum(45)m =		1917.2669	
Distribution loss (46)m = 0.15 x (45)m	29.8170	26.2631	27.6129	23.5658	22.3650	19.6293	18.9821	20.0225	20.5612	23.5560	25.8191	29.3960	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
									Total per year (kWh/year) = Sum(64)m =			2164.2989	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	82.8790	73.3769	77.9933	68.4808	66.3603	59.7547	58.8617	61.1679	61.8205	69.0004	73.4754	81.9459	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.0740	16.9413	13.7776	10.4305	7.7970	6.5825	7.1126	9.2453	12.4090	15.7561	18.3897	19.6041	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.1398	217.3723	211.7465	199.7699	184.6516	170.4425	160.9500	158.7175	164.3433	176.3199	191.4382	205.6473	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	(71)
Water heating gains (Table 5)	111.3965	109.1918	104.8296	95.1122	89.1940	82.9927	79.1152	82.2149	85.8618	92.7424	102.0492	110.1423	(72)
Total internal gains	425.2988	423.1939	410.0422	385.0011	361.3310	339.7061	326.8663	329.8661	342.3025	364.5068	391.5655	415.0821	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	4.2200	11.2829	0.6300	0.8270	0.7700	17.1915	(75)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	17.1915	34.9938	63.0477	103.5425	139.1814	148.3821	138.8084	110.6597	76.8246	42.7652	21.6314	14.0395	(83)
Total gains	442.4903	458.1877	473.0899	488.5436	500.5124	488.0882	465.6747	440.5258	419.1272	407.2721	413.1969	429.1215	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	144.4740	145.3335	146.2034	150.7135	151.6492	156.5071	156.5071	157.5163	154.5271	151.6492	149.7894	147.9747	
alpha	10.6316	10.6889	10.7469	11.0476	11.1099	11.4338	11.4338	11.5011	11.3018	11.1099	10.9860	10.8650	
util living area	0.7109	0.6607	0.5747	0.4510	0.3363	0.2299	0.1657	0.1819	0.2924	0.4621	0.6152	0.7198	(86)
MIT	20.9918	20.9960	20.9991	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9999	20.9985	20.9917	(87)
Th 2	20.6234	20.6256	20.6277	20.6385	20.6407	20.6515	20.6515	20.6537	20.6472	20.6407	20.6364	20.6321	(88)
util rest of house	0.6959	0.6459	0.5601	0.4375	0.3233	0.2174	0.1526	0.1682	0.2774	0.4461	0.5993	0.7051	(89)
MIT 2	20.6149	20.6215	20.6268	20.6385	20.6407	20.6515	20.6515	20.6537	20.6472	20.6406	20.6349	20.6234	(90)
Living area fraction										fLA = Living area / (4) =		0.5530	(91)
MIT	20.8233	20.8286	20.8327	20.8384	20.8394	20.8442	20.8442	20.8452	20.8423	20.8393	20.8360	20.8270	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.8233	20.8286	20.8327	20.8384	20.8394	20.8442	20.8442	20.8452	20.8423	20.8393	20.8360	20.8270	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7039	0.6540	0.5681	0.4450	0.3305	0.2243	0.1598	0.1758	0.2857	0.4550	0.6081	0.7129	(94)
Useful gains	311.4658	299.6348	268.7750	217.3782	165.3980	109.4960	74.4247	77.4494	119.7448	185.2886	251.2461	305.9341	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	313.8790	300.7928	269.0448	217.3940	165.3985	109.4960	74.4247	77.4494	119.7449	185.3046	251.6712	308.3773	(97)
Space heating kWh	1.7954	0.7782	0.2007	0.0113	0.0004	0.0000	0.0000	0.0000	0.0000	0.0119	0.3061	1.8178	(98a)
Space heating requirement - total per year (kWh/year)												4.9218	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	1.7954	0.7782	0.2007	0.0113	0.0004	0.0000	0.0000	0.0000	0.0000	0.0119	0.3061	1.8178	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4.9218	
Space heating per m2										(98c) / (4) =		0.1008	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1.7954	0.7782	0.2007	0.0113	0.0004	0.0000	0.0000	0.0000	0.0000	0.0119	0.3061	1.8178	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	1.7954	0.7782	0.2007	0.0113	0.0004	0.0000	0.0000	0.0000	0.0000	0.0119	0.3061	1.8178	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.4966	7.6744	8.4966	8.2225	8.4966	8.2225	8.4966	8.4966	8.2225	8.4966	8.2225	8.4966	(231)
Lighting	16.6953	13.3936	12.0595	8.8353	6.8246	5.5758	6.2257	8.0923	10.5112	13.7912	15.5771	17.1594	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.6057	-18.5259	-30.3122	-38.4756	-45.4210	-43.7997	-43.1129	-38.8271	-31.5899	-22.8900	-13.4515	-9.7746	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.2799	-5.2783	-11.6366	-19.3403	-27.0617	-27.8130	-27.4113	-22.1498	-15.0998	-7.9499	-3.1503	-1.7531	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	4.9218	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2164.2989	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	100.0410	(230a)
Total electricity for the above, kWh/year	100.0410	(231)
Electricity for lighting (calculated in Appendix L)	134.7410	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-518.7101	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1885.2926	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4.9218	16.4900	0.8116	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	16.4900	356.8929	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	100.0410	16.4900	16.4968	(249)
Energy for lighting	134.7410	16.4900	22.2188	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.7861	16.4900	-57.3499	
PV Unit electricity exported	-170.9240	5.5900	-9.5546	
Total			-66.9046	(252)
Total energy cost			329.5155	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2645	(257)
SAP value	79.5020	
SAP rating (Section 12)	80	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4.9218	0.1613	0.7937	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2164.2989	0.1413	305.7097	(264)
Space and water heating			306.5034	(265)
Pumps, fans and electric keep-hot	100.0410	0.1387	13.8769	(267)
Energy for lighting	134.7410	0.1443	19.4473	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.7861	0.1322	-45.9728	
PV Unit electricity exported	-170.9240	0.1235	-21.1019	
Total			-67.0747	(269)
Total CO2, kg/year			272.7529	(272)
CO2 emissions per m2			5.5900	(273)
EI value			96.1039	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.8100	(1b)	x 2.4000	(2b) =	117.1440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.8100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		117.1440	(5)

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2. Ventilation rate

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m3 per hour

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery		
If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			4.2200	1.2357	5.2148			(27)
External Wall 1	14.1700	4.2200	9.9500	0.1400	1.3930	14.0000	139.3000	(29a)
Total net area of external elements Aum(A, m2)			14.1700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		6.6078			(33)
Party Wall 1			24.8400	0.0000	0.0000	20.0000	496.8000	(32)
Wall to corridor			39.0100	0.0000	0.0000	20.0000	780.2000	(32)
Party Floor 1			48.8100			80.0000	3904.8000	(32d)
Party Ceiling 1			48.8100			80.0000	3904.8000	(32b)
Internal Wall 1			72.6800			9.0000	654.1200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9880.0200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.4179 (35)
List of Thermal Bridges		

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	1.8200	0.0500	0.0910
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.2500	0.0700	0.3675
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	20.8400	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.2465 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	7.8543 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.2542	11.2542	11.0295	10.3554	10.2430	9.7936	9.5689	9.5689	10.0183	10.5801	10.8048	10.6924	(38)
Heat transfer coeff	19.1085	19.1085	18.8838	18.2097	18.0974	17.6480	17.4233	17.4233	17.8727	18.4344	18.6591	18.5468	(39)
Average = Sum(39)m / 12 =												18.2846	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.3915	0.3915	0.3869	0.3731	0.3708	0.3616	0.3570	0.3570	0.3662	0.3777	0.3823	0.3800	(40)
HLP (average)												0.3746	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.6551 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
71.4595	70.3856	68.8207	65.8266	63.6170	61.1529	59.7523	61.3053	63.0077	65.6534	68.7119	71.1857	(42a)

Hot water usage for baths

22.4723	22.1385	21.6685	20.8020	20.1531	19.4336	19.0450	19.5117	20.0198	20.7897	21.6741	22.3963	(42b)

Hot water usage for other uses

31.5802	30.4318	29.2834	28.1350	26.9867	25.8383	25.8383	26.9867	28.1350	29.2834	30.4318	31.5802	(42c)

Average daily hot water use (litres/day)		115.4278 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	125.5119	122.9558	119.7726	114.7636	110.7568	106.4248	104.6356	107.8037	111.1626	115.7265	120.8177	125.1621	(44)
Energy conte	198.7801	175.0875	184.0861	157.1056	149.0999	130.8617	126.5476	133.4834	137.0746	157.0398	172.1270	195.9736	(45)
Energy content (annual)										Total = Sum(45)m =		1917.2669	
Distribution loss (46)m = 0.15 x (45)m													
	29.8170	26.2631	27.6129	23.5658	22.3650	19.6293	18.9821	20.0225	20.5612	23.5560	25.8191	29.3960	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
										Total per year (kWh/year) = Sum(64)m =		2164.2989	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						0.0000	(64a)
Heat gains from water heating, kWh/month													
	82.8790	73.3769	77.9933	68.4808	66.3603	59.7547	58.8617	61.1679	61.8205	69.0004	73.4754	81.9459	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.0740	16.9413	13.7776	10.4305	7.7970	6.5825	7.1126	9.2453	12.4090	15.7561	18.3897	19.6041	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	215.1398	217.3723	211.7465	199.7699	184.6516	170.4425	160.9500	158.7175	164.3433	176.3199	191.4382	205.6473	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	(71)
Water heating gains (Table 5)													
	111.3965	109.1918	104.8296	95.1122	89.1940	82.9927	79.1152	82.2149	85.8618	92.7424	102.0492	110.1423	(72)
Total internal gains													
	425.2988	423.1939	410.0422	385.0011	361.3310	339.7061	326.8663	329.8661	342.3025	364.5068	391.5655	415.0821	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	4.2200	10.0309	0.6300	0.8270	0.7700	15.2838	(75)

Solar gains	15.2838	33.0890	62.1941	107.7628	144.1061	149.7318	141.6342	109.2990	75.1529	40.1487	19.7409	12.7801	(83)
Total gains	440.5826	456.2829	472.2363	492.7639	505.4371	489.4379	468.5005	439.1651	417.4554	404.6555	411.3064	427.8622	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	143.6246	143.6246	145.3335	150.7135	151.6492	155.5108	157.5163	157.5163	153.5557	148.8765	147.0837	147.9747	
alpha	10.5750	10.5750	10.6889	11.0476	11.1099	11.3674	11.5011	11.5011	11.2370	10.9251	10.8056	10.8650	
util living area													
	0.7333	0.6945	0.6145	0.4840	0.3688	0.2812	0.2269	0.2460	0.3511	0.5146	0.6510	0.7414	(86)
MIT	20.9886	20.9931	20.9981	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9998	20.9971	20.9887	(87)
Th 2	20.6213	20.6213	20.6256	20.6385	20.6407	20.6493	20.6537	20.6537	20.6450	20.6342	20.6299	20.6321	(88)
util rest of house													
	0.7184	0.6796	0.5998	0.4707	0.3559	0.2686	0.2140	0.2322	0.3359	0.4980	0.6347	0.7270	(89)
MIT 2	20.6094	20.6142	20.6236	20.6384	20.6407	20.6493	20.6537	20.6537	20.6450	20.6340	20.6270	20.6202	(90)
Living area fraction										fLA = Living area / (4) =		0.5530	(91)
MIT	20.8191	20.8237	20.8307	20.8383	20.8394	20.8432	20.8452	20.8452	20.8413	20.8363	20.8317	20.8240	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.8191	20.8237	20.8307	20.8383	20.8394	20.8432	20.8452	20.8452	20.8413	20.8363	20.8317	20.8240	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7262	0.6876	0.6079	0.4781	0.3630	0.2756	0.2211	0.2398	0.3443	0.5072	0.6436	0.7346	(94)
Useful gains	319.9441	313.7342	287.0503	235.5670	183.4943	134.8876	103.5843	105.3267	143.7189	205.2295	264.7127	314.2864	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	323.2978	315.7439	287.6131	235.6024	183.4958	134.8876	103.5843	105.3267	143.7195	205.2905	265.5499	317.5946	(97)
Space heating kWh													
	2.4952	1.3505	0.4188	0.0255	0.0011	0.0000	0.0000	0.0000	0.0000	0.0454	0.6028	2.4613	(98a)
Space heating requirement - total per year (kWh/year)												7.4006	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	2.4952	1.3505	0.4188	0.0255	0.0011	0.0000	0.0000	0.0000	0.0000	0.0454	0.6028	2.4613	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7.4006	
Space heating per m2											(98c) / (4) =	0.1516	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement												

	2.4952	1.3505	0.4188	0.0255	0.0011	0.0000	0.0000	0.0000	0.0000	0.0454	0.6028	2.4613 (98)
Space heating efficiency (main heating system 1)												
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)												
	2.4952	1.3505	0.4188	0.0255	0.0011	0.0000	0.0000	0.0000	0.0000	0.0454	0.6028	2.4613 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	8.4966	7.6744	8.4966	8.2225	8.4966	8.2225	8.4966	8.4966	8.2225	8.4966	8.2225	8.4966 (231)
Lighting	16.6953	13.3936	12.0595	8.8353	6.8246	5.5758	6.2257	8.0923	10.5112	13.7912	15.5771	17.1594 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-10.5053	-17.8142	-30.3063	-40.1273	-47.0520	-44.4497	-44.1326	-38.8391	-31.3783	-21.9178	-12.4956	-9.0275 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-1.9399	-4.9409	-11.6282	-20.8513	-28.8824	-28.5884	-28.6349	-22.1624	-14.9212	-7.3858	-2.7918	-1.5419 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	7.4006 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2164.2989 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	100.0410 (230a)
Total electricity for the above, kWh/year	100.0410 (231)
Electricity for lighting (calculated in Appendix L)	134.7410 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-522.3147 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1884.1667 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	7.4006	25.1600	1.8620	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	25.1600	544.5376	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	100.0410	25.1600	25.1703	(249)
Energy for lighting	134.7410	25.1600	33.9008	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-348.0458	25.1600	-87.5683	
PV Unit electricity exported	-174.2689	5.8100	-10.1250	
Total			-97.6934	(252)
Total energy cost			507.7774	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	7.4006	0.1607	1.1890	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2164.2989	0.1413	305.7097	(264)
Space and water heating			306.8988	(265)
Pumps, fans and electric keep-hot	100.0410	0.1387	13.8769	(267)
Energy for lighting	134.7410	0.1443	19.4473	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-348.0458	0.1319	-45.8985	
PV Unit electricity exported	-174.2689	0.1230	-21.4320	
Total			-67.3305	(269)
Total CO2, kg/year			272.8924	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year

Space heating - main system 1	7.4006	1.5946	11.8013	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	1.5223	3294.7406	(278)
Space and water heating			3306.5418	(279)
Pumps, fans and electric keep-hot	100.0410	1.5128	151.3420	(281)
Energy for lighting	134.7410	1.5338	206.6703	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-348.0458	1.4872	-517.6275	
PV Unit electricity exported	-174.2689	0.4513	-78.6547	
Total			-596.2822	(283)
Total Primary energy kWh/year			3068.2718	(286)

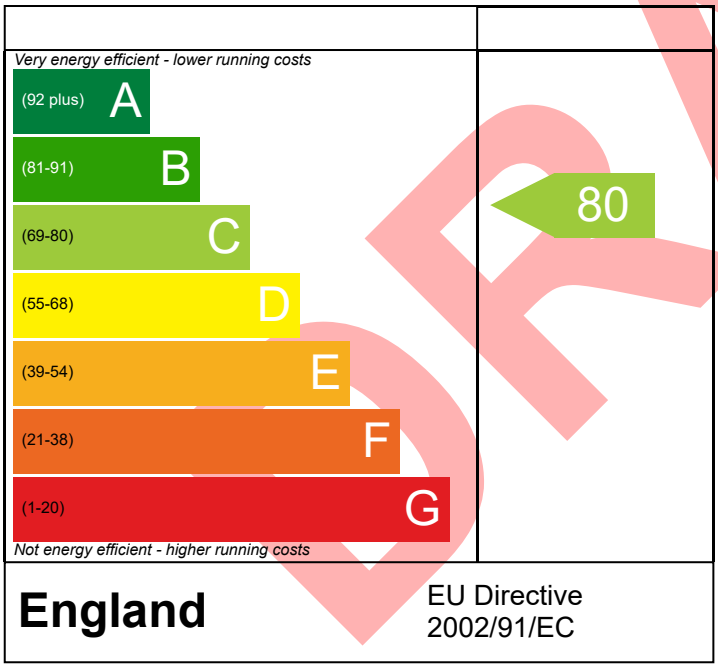
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	48.81 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

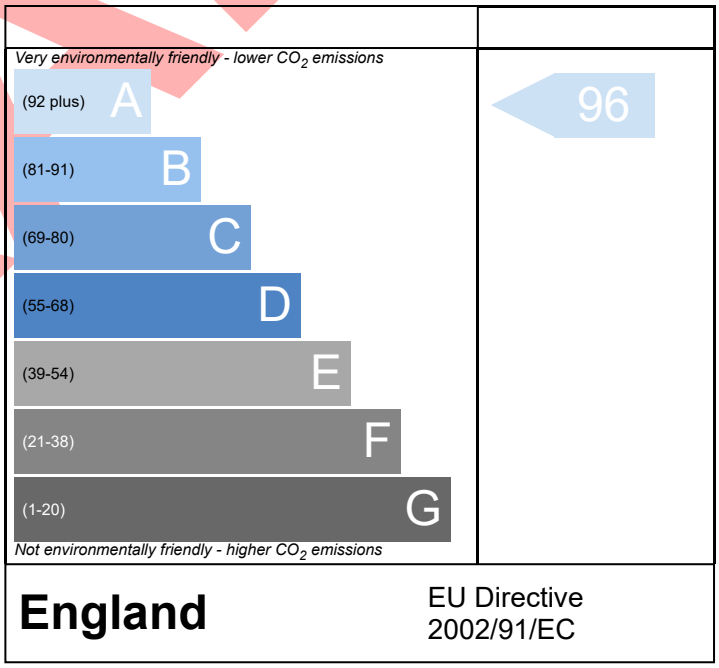
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:53

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	72 m^2
Site Reference	Unit 350 L06 _Copy	Plot Reference	Unit 350 L06_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.66 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	5.29 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*63.0 kWh_{PE}/m^2*	
Dwelling primary energy	59.0 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*24.4 kWh/m^2*	
Dwelling fabric energy efficiency	23.0 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	17.85	0.14 **(!)**
Party wall: Party Wall (1)	41.71	0 **(!)**
Party wall: Party Wall (2)	22.81	0 **(!)**
Exposed roof: Roof (1)	15.7	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	10.77	North East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	
External wall	E15: Flat roof with parapet	Calculated by person with suitable expertise	0.56	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.12	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.93 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 350 L06 _Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 350 L06_Copy	**Prop Type Ref**	Unit 350 L06
Property			

SAP Rating	78 C	**DER**	5.29	**TER**	11.66
Environmental	96 A	**% DER < TER**			54.63
CO_2 Emissions (t/year)	0.38	**DFEE**	23.03	**TFEE**	24.38
Compliance Check	See BREL	**% DFEE < TFEE**			5.57
% DPER < TPER	6.35	**DPER**	59.00	**TPER**	63.00

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	71.6800 (1b)	x	2.4000 (2b)	=	172.0320	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.6800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	172.0320	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.7700	1.2357	13.3089			(27)
External Wall 1	28.6200	10.7700	17.8500	0.1400	2.4990	14.0000	249.9000	(29a)
External Roof 1	15.7000		15.7000	0.1100	1.7270	9.0000	141.3000	(30)
Total net area of external elements Aum(A, m2)			44.3200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	17.5349			(33)
Party Wall 1			41.7100	0.0000	0.0000	20.0000	834.2000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			71.6800			80.0000	5734.4000	(32d)
Party Ceiling 1			61.5400			80.0000	4923.2000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13576.0700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		189.3983 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	4.6400	0.0500	0.2320	
E4 Jamb	13.9200	0.0500	0.6960	
E7 Party floor between dwellings (in blocks of flats)	21.2000	0.0700	1.4840	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
E16 Corner (normal)	2.7000	0.0900	0.2430	
E15 Flat roof with parapet	10.1900	0.5600	5.7064	
P4 Party wall - Roof (insulation at ceiling level)	1.1700	0.1200	0.1404	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	45.4400	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.8258 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 26.3607 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3623	16.1974	16.0324	15.2074	15.0424	14.2175	14.2175	14.0525	14.5475	15.0424	15.3724	15.7024	(38)
Heat transfer coeff	42.7231	42.5581	42.3931	41.5681	41.4032	40.5782	40.5782	40.4132	40.9082	41.4032	41.7331	42.0631	(39)
Average = Sum(39)m / 12 =												41.5269	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5960	0.5937	0.5914	0.5799	0.5776	0.5661	0.5661	0.5638	0.5707	0.5776	0.5822	0.5868	(40)
HLP (average)												0.5793	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2862 (42)

Hot water usage for mixer showers												
	86.0089	84.7163	82.8328	79.2291	76.5696	73.6038	71.9181	73.7873	75.8363	79.0207	82.7018	85.6793 (42a)
Hot water usage for baths												
	27.0226	26.6213	26.0561	25.0141	24.2338	23.3686	22.9013	23.4625	24.0735	24.9993	26.0628	26.9312 (42b)
Hot water usage for other uses												
	38.0431	36.6597	35.2763	33.8929	32.5095	31.1262	31.1262	32.5095	33.8929	35.2763	36.6597	38.0431 (42c)
Average daily hot water use (litres/day)												138.9361 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	151.0745	147.9973	144.1652	138.1361	133.3130	128.0986	125.9455	129.7594	133.8028	139.2963	145.4243	150.6536	(44)
Energy conte	239.2651	210.7461	221.5766	189.1014	179.4649	157.5122	152.3202	160.6692	164.9922	189.0238	207.1836	235.8872	(45)
Energy content (annual)										Total = Sum(45)m =		2307.7426	
Distribution loss (46)m = 0.15 x (45)m													
	35.8898	31.6119	33.2365	28.3652	26.9197	23.6268	22.8480	24.1004	24.7488	28.3536	31.0775	35.3831	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)
										Total per year (kWh/year) = Sum(64)m =		2554.7746	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	96.3403	85.2334	90.4589	79.1194	76.4567	68.6160	67.4311	70.2071	71.1031	79.6351	85.1318	95.2171	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.7067	21.0560	17.1239	12.9639	9.6907	8.1813	8.8402	11.4908	15.4229	19.5829	22.8561	24.3655	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	300.2774	303.3934	295.5413	278.8252	257.7241	237.8920	224.6430	221.5270	229.3791	246.0952	267.1963	287.0284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	(71)
Water heating gains (Table 5)													
	129.4896	126.8354	121.5845	109.8881	102.7644	95.3000	90.6332	94.3644	98.7543	107.0364	118.2386	127.9800	(72)
Total internal gains													
	550.2014	548.0125	530.9774	498.4048	466.9068	438.1010	420.8440	424.1099	440.2840	469.4422	505.0187	536.1016	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.7700	11.2829	0.6300	0.8270	0.7700	43.8750	(75)

Solar gains	43.8750	89.3089	160.9062	264.2542	355.2095	378.6909	354.2576	282.4182	196.0667	109.1425	55.2061	35.8305	(83)
Total gains	594.0764	637.3214	691.8836	762.6590	822.1163	816.7919	775.1016	706.5281	636.3507	578.5847	560.2248	571.9322	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	88.2692	88.6114	88.9562	90.7216	91.0832	92.9349	92.9349	93.3143	92.1852	91.0832	90.3630	89.6541	
alpha	6.8846	6.9074	6.9304	7.0481	7.0722	7.1957	7.1957	7.2210	7.1457	7.0722	7.0242	6.9769	
util living area	0.9379	0.9028	0.8167	0.6471	0.4672	0.3179	0.2303	0.2631	0.4428	0.7183	0.8901	0.9465	(86)
MIT	20.6696	20.7678	20.8949	20.9800	20.9980	20.9999	21.0000	21.0000	20.9990	20.9681	20.8272	20.6497	(87)
Th 2	20.4336	20.4357	20.4377	20.4481	20.4502	20.4606	20.4606	20.4627	20.4564	20.4502	20.4460	20.4419	(88)
util rest of house	0.9281	0.8890	0.7955	0.6203	0.4399	0.2911	0.2021	0.2324	0.4082	0.6862	0.8728	0.9378	(89)
MIT 2	20.0595	20.1789	20.3278	20.4291	20.4485	20.4605	20.4606	20.4627	20.4557	20.4208	20.2609	20.0427	(90)
Living area fraction										fLA = Living area / (4) =		0.4021	(91)
MIT	20.3048	20.4157	20.5558	20.6506	20.6694	20.6774	20.6775	20.6787	20.6742	20.6408	20.4886	20.2868	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3048	20.4157	20.5558	20.6506	20.6694	20.6774	20.6775	20.6787	20.6742	20.6408	20.4886	20.2868	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9256	0.8885	0.8001	0.6302	0.4508	0.3019	0.2135	0.2447	0.4221	0.6975	0.8742	0.9352	(94)
Useful gains	549.9015	566.2396	553.5723	480.6358	370.6235	246.5788	165.4545	172.9114	268.6069	403.5843	489.7594	534.8477	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	683.7740	660.3173	595.8708	488.4502	371.3625	246.6099	165.4565	172.9164	268.9370	415.7229	558.7489	676.6592	(97)
Space heating kWh	99.6012	63.2202	31.4701	5.6263	0.5498	0.0000	0.0000	0.0000	0.0000	9.0311	49.6725	105.5078	(98a)
Space heating requirement - total per year (kWh/year)												364.6790	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	99.6012	63.2202	31.4701	5.6263	0.5498	0.0000	0.0000	0.0000	0.0000	9.0311	49.6725	105.5078	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												364.6790	
Space heating per m2											(98c) / (4) =	5.0876	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 100.0000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	99.6012	63.2202	31.4701	5.6263	0.5498	0.0000	0.0000	0.0000	0.0000	9.0311	49.6725	105.5078	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	99.6012	63.2202	31.4701	5.6263	0.5498	0.0000	0.0000	0.0000	0.0000	9.0311	49.6725	105.5078	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.2264	11.9464	13.2264	12.7997	13.2264	12.7997	13.2264	13.2264	12.7997	13.2264	12.7997	13.2264	(231)
Lighting	20.7503	16.6467	14.9885	10.9812	8.4822	6.9300	7.7377	10.0578	13.0641	17.1408	19.3605	21.3270	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-17.1590	-27.2559	-44.0811	-55.1768	-64.6613	-62.2021	-61.2121	-55.2791	-45.1928	-33.1010	-19.7467	-14.4640	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.3389	-7.8837	-17.8434	-30.1705	-42.3370	-43.5118	-42.8950	-34.7344	-23.7301	-12.4245	-4.7606	-2.5531	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 364.6790 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 100.0000

Water heating fuel used 2554.7746 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)

mechanical ventilation fans (SFP = 0.7420) 155.7302 (230a)

Total electricity for the above, kWh/year 155.7302 (231)

Electricity for lighting (calculated in Appendix L) 167.4668 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation -765.7149 (233)

Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2476.9358	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	364.6790	16.4900	60.1356	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	16.4900	421.2823	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	155.7302	16.4900	25.6799	(249)
Energy for lighting	167.4668	16.4900	27.6153	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-499.5319	16.4900	-82.3728	
PV Unit electricity exported	-266.1831	5.5900	-14.8796	
Total			-97.2524	(252)
Total energy cost			437.4607	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.3497	(257)
SAP value		78.1210	
SAP rating (Section 12)		78	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	364.6790	0.1590	57.9688	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2554.7746	0.1413	360.9927	(264)
Space and water heating			418.9615	(265)
Pumps, fans and electric keep-hot	155.7302	0.1387	21.6017	(267)
Energy for lighting	167.4668	0.1443	24.1706	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-499.5319	0.1324	-66.1325	
PV Unit electricity exported	-266.1831	0.1231	-32.7738	
Total			-98.9063	(269)
Total CO2, kg/year			365.8275	(272)
CO2 emissions per m2			5.1000	(273)
EI value			95.7987	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	71.6800	(1b)	x 2.4000	(2b) =	172.0320	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.6800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		172.0320	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)

Number of sides sheltered 3 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.7700	1.2357	13.3089			(27)
External Wall 1	28.6200	10.7700	17.8500	0.1400	2.4990	14.0000	249.9000	(29a)
External Roof 1	15.7000		15.7000	0.1100	1.7270	9.0000	141.3000	(30)
Total net area of external elements Aum(A, m2)			44.3200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		17.5349			(33)
Party Wall 1			41.7100	0.0000	0.0000	20.0000	834.2000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			71.6800			80.0000	5734.4000	(32d)
Party Ceiling 1			61.5400			80.0000	4923.2000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13576.0700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 189.3983 (35)
List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	4.6400	0.0500	0.2320
E4	Jamb	13.9200	0.0500	0.6960
E7	Party floor between dwellings (in blocks of flats)	21.2000	0.0700	1.4840
E18	Party wall between dwellings	5.4000	0.0600	0.3240
E16	Corner (normal)	2.7000	0.0900	0.2430
E15	Flat roof with parapet	10.1900	0.5600	5.7064
P4	Party wall - Roof (insulation at ceiling level)	1.1700	0.1200	0.1404
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	45.4400	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.8258 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 26.3607 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.5273	16.5273	16.1974	15.2074	15.0424	14.3825	14.0525	14.0525	14.7124	15.5374	15.8674	15.7024	(38)
Heat transfer coeff	42.8881	42.8881	42.5581	41.5681	41.4032	40.7432	40.4132	40.4132	41.0732	41.8981	42.2281	42.0631	(39)

Average = Sum(39)m / 12 = 41.6781

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5983	0.5983	0.5937	0.5799	0.5776	0.5684	0.5638	0.5638	0.5730	0.5845	0.5891	0.5868	(40)
HLP (average)												0.5814	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2862 (42)
Hot water usage for mixer showers

86.0089	84.7163	82.8328	79.2291	76.5696	73.6038	71.9181	73.7873	75.8363	79.0207	82.7018	85.6793	(42a)

Hot water usage for baths

27.0226	26.6213	26.0561	25.0141	24.2338	23.3686	22.9013	23.4625	24.0735	24.9993	26.0628	26.9312	(42b)

Hot water usage for other uses

38.0431	36.6597	35.2763	33.8929	32.5095	31.1262	31.1262	32.5095	33.8929	35.2763	36.6597	38.0431	(42c)

Average daily hot water use (litres/day) 138.9361 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.0745	147.9973	144.1652	138.1361	133.3130	128.0986	125.9455	129.7594	133.8028	139.2963	145.4243	150.6536	(44)
Energy conte	239.2651	210.7461	221.5766	189.1014	179.4649	157.5122	152.3202	160.6692	164.9922	189.0238	207.1836	235.8872	(45)
Energy content (annual)										Total = Sum(45)m =		2307.7426	
Distribution loss (46)m = 0.15 x (45)m	35.8898	31.6119	33.2365	28.3652	26.9197	23.6268	22.8480	24.1004	24.7488	28.3536	31.0775	35.3831	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h												
260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)
									Total per year (kWh/year) = Sum(64)m =		2554.7746	(64)
Electric shower(s)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

96.3403	85.2334	90.4589	79.1194	76.4567	68.6160	67.4311	70.2071	71.1031	79.6351	85.1318	95.2171	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.7067	21.0560	17.1239	12.9639	9.6907	8.1813	8.8402	11.4908	15.4229	19.5829	22.8561	24.3655	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	300.2774	303.3934	295.5413	278.8252	257.7241	237.8920	224.6430	221.5270	229.3791	246.0952	267.1963	287.0284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	(71)
Water heating gains (Table 5)													
	129.4896	126.8354	121.5845	109.8881	102.7644	95.3000	90.6332	94.3644	98.7543	107.0364	118.2386	127.9800	(72)
Total internal gains													
	550.2014	548.0125	530.9774	498.4048	466.9068	438.1010	420.8440	424.1099	440.2840	469.4422	505.0187	536.1016	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.7700	10.0309	0.6300	0.8270	0.7700	39.0064	(75)

Solar gains	39.0064	84.4476	158.7276	275.0250	367.7778	382.1355	361.4694	278.9456	191.8002	102.4648	50.3815	32.6165	(83)
Total gains	589.2078	632.4601	689.7050	773.4299	834.6846	820.2364	782.3134	703.0555	632.0842	571.9070	555.4001	568.7181	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	87.9296	87.9296	88.6114	90.7216	91.0832	92.5585	93.3143	93.3143	91.8149	90.0071	89.3038	89.6541	
alpha	6.8620	6.8620	6.9074	7.0481	7.0722	7.1706	7.2210	7.2210	7.1210	7.0005	6.9536	6.9769	
util living area													
	0.9467	0.9202	0.8502	0.6854	0.5087	0.3872	0.3151	0.3563	0.5300	0.7791	0.9102	0.9545	(86)
MIT	20.6290	20.7163	20.8540	20.9693	20.9961	20.9995	20.9999	20.9998	20.9962	20.9409	20.7828	20.6083	(87)
Th 2	20.4315	20.4315	20.4357	20.4481	20.4502	20.4585	20.4627	20.4627	20.4544	20.4440	20.4398	20.4419	(88)
util rest of house													
	0.9381	0.9084	0.8318	0.6601	0.4822	0.3604	0.2873	0.3254	0.4956	0.7503	0.8954	0.9471	(89)
MIT 2	20.0079	20.1135	20.2791	20.4180	20.4468	20.4582	20.4626	20.4626	20.4514	20.3867	20.2030	19.9916	(90)
Living area fraction									fLA = Living area / (4) =			0.4021	(91)
MIT	20.2576	20.3559	20.5102	20.6397	20.6677	20.6758	20.6787	20.6786	20.6704	20.6096	20.4361	20.2396	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2576	20.3559	20.5102	20.6397	20.6677	20.6758	20.6787	20.6786	20.6704	20.6096	20.4361	20.2396	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9352	0.9067	0.8343	0.6690	0.4927	0.3712	0.2985	0.3378	0.5093	0.7591	0.8953	0.9441	(94)
Useful gains	551.0384	573.4614	575.4341	517.4227	411.2570	304.4321	233.5076	237.5095	321.9247	434.1573	497.2397	536.9015	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	701.5473	688.6045	634.5512	529.5658	412.6943	304.5896	233.5341	237.5718	323.2632	457.0899	584.2738	695.7054	(97)
Space heating kWh													
	111.9786	77.3762	43.9831	8.7430	1.0693	0.0000	0.0000	0.0000	0.0000	17.0619	62.6645	118.1501	(98a)
Space heating requirement - total per year (kWh/year)												441.0267	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	111.9786	77.3762	43.9831	8.7430	1.0693	0.0000	0.0000	0.0000	0.0000	17.0619	62.6645	118.1501	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												441.0267	
Space heating per m2											(98c) / (4) =	6.1527	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	111.9786	77.3762	43.9831	8.7430	1.0693	0.0000	0.0000	0.0000	0.0000	17.0619	62.6645	118.1501	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	111.9786	77.3762	43.9831	8.7430	1.0693	0.0000	0.0000	0.0000	0.0000	17.0619	62.6645	118.1501	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating

Water heating requirement

	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	13.2264	11.9464	13.2264	12.7997	13.2264	12.7997	13.2264	13.2264	12.7997	13.2264	12.7997	13.2264 (231)
Lighting	20.7503	16.6467	14.9885	10.9812	8.4822	6.9300	7.7377	10.0578	13.0641	17.1408	19.3605	21.3270 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-15.5542	-26.2913	-44.2435	-57.5885	-66.9459	-63.1006	-62.6205	-55.2958	-44.8961	-31.8003	-18.3940	-13.3765 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.8173	-7.2996	-17.6598	-32.4274	-45.1477	-44.7175	-44.7982	-34.7540	-23.4507	-11.4574	-4.1731	-2.2259 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	441.0267 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2554.7746 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	155.7302 (230a)
Total electricity for the above, kWh/year	155.7302 (231)
Electricity for lighting (calculated in Appendix L)	167.4668 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-771.0360 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2547.9624 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	441.0267	25.1600	110.9623	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	25.1600	642.7813	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	155.7302	25.1600	39.1817	(249)
Energy for lighting	167.4668	25.1600	42.1347	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-500.1072	25.1600	-125.8270	
PV Unit electricity exported	-270.9288	5.8100	-15.7410	
Total			-141.5679	(252)
Total energy cost			693.4921	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	441.0267	0.1583	69.7947	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2554.7746	0.1413	360.9927	(264)
Space and water heating			430.7874	(265)
Pumps, fans and electric keep-hot	155.7302	0.1387	21.6017	(267)
Energy for lighting	167.4668	0.1443	24.1706	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-500.1072	0.1321	-66.0593	
PV Unit electricity exported	-270.9288	0.1226	-33.2131	
Total			-99.2724	(269)
Total CO2, kg/year			377.2873	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	441.0267	1.5858	699.3875	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	1.5225	3889.6458	(278)
Space and water heating			4589.0333	(279)
Pumps, fans and electric keep-hot	155.7302	1.5128	235.5887	(281)
Energy for lighting	167.4668	1.5338	256.8662	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-500.1072	1.4880	-744.1844	
PV Unit electricity exported	-270.9288	0.4499	-121.8889	
Total			-866.0733	(283)
Total Primary energy kWh/year			4215.4150	(286)

SAP 10 EPC IMPROVEMENTS

Unit 350 L06_Copy

Current energy efficiency rating: C 78
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 78
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£835	£835	£0
Space heating	£150	£150	£0
Water heating	£643	£643	£0
Lighting	£42	£42	£0
Generated (PV)	-£142	-£142	£0
Total cost of fuels	£693	£693	£0
Total cost of uses	£693	£693	£0
Delivered energy	36 kWh/m²	36 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	59 kWh/m²	59 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	71.6800 (1b)	x	2.4000 (2b)	=	172.0320	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.6800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	172.0320	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.7700	1.2357	13.3089			(27)
External Wall 1	28.6200	10.7700	17.8500	0.1400	2.4990	14.0000	249.9000	(29a)
External Roof 1	15.7000		15.7000	0.1100	1.7270	9.0000	141.3000	(30)
Total net area of external elements Aum(A, m2)			44.3200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	17.5349			(33)
Party Wall 1			41.7100	0.0000	0.0000	20.0000	834.2000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			71.6800			80.0000	5734.4000	(32d)
Party Ceiling 1			61.5400			80.0000	4923.2000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13576.0700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		189.3983 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	4.6400	0.0500	0.2320
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	21.2000	0.0700	1.4840
E18 Party wall between dwellings	5.4000	0.0600	0.3240
E16 Corner (normal)	2.7000	0.0900	0.2430
E15 Flat roof with parapet	10.1900	0.5600	5.7064
P4 Party wall - Roof (insulation at ceiling level)	1.1700	0.1200	0.1404
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	45.4400	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.8258 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	26.3607 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3623	16.1974	16.0324	15.2074	15.0424	14.2175	14.2175	14.0525	14.5475	15.0424	15.3724	15.7024	(38)
Heat transfer coeff	42.7231	42.5581	42.3931	41.5681	41.4032	40.5782	40.5782	40.4132	40.9082	41.4032	41.7331	42.0631	(39)
Average = Sum(39)m / 12 =												41.5269	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5960	0.5937	0.5914	0.5799	0.5776	0.5661	0.5661	0.5638	0.5707	0.5776	0.5822	0.5868	(40)
HLP (average)												0.5793	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy											2.2862	(42)
Hot water usage for mixer showers	86.0089	84.7163	82.8328	79.2291	76.5696	73.6038	71.9181	73.7873	75.8363	79.0207	82.7018	85.6793	(42a)
Hot water usage for baths	27.0226	26.6213	26.0561	25.0141	24.2338	23.3686	22.9013	23.4625	24.0735	24.9993	26.0628	26.9312	(42b)
Hot water usage for other uses	38.0431	36.6597	35.2763	33.8929	32.5095	31.1262	31.1262	32.5095	33.8929	35.2763	36.6597	38.0431	(42c)
Average daily hot water use (litres/day)												138.9361	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.0745	147.9973	144.1652	138.1361	133.3130	128.0986	125.9455	129.7594	133.8028	139.2963	145.4243	150.6536	(44)
Energy conte	239.2651	210.7461	221.5766	189.1014	179.4649	157.5122	152.3202	160.6692	164.9922	189.0238	207.1836	235.8872	(45)
Energy content (annual)										Total = Sum(45)m =		2307.7426	
Distribution loss (46)m = 0.15 x (45)m	35.8898	31.6119	33.2365	28.3652	26.9197	23.6268	22.8480	24.1004	24.7488	28.3536	31.0775	35.3831	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)
										Total per year (kWh/year) = Sum(64)m =		2554.7746	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	96.3403	85.2334	90.4589	79.1194	76.4567	68.6160	67.4311	70.2071	71.1031	79.6351	85.1318	95.2171	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.7067	21.0560	17.1239	12.9639	9.6907	8.1813	8.8402	11.4908	15.4229	19.5829	22.8561	24.3655	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	300.2774	303.3934	295.5413	278.8252	257.7241	237.8920	224.6430	221.5270	229.3791	246.0952	267.1963	287.0284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	(69)

Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	(71)
Water heating gains (Table 5)													
	129.4896	126.8354	121.5845	109.8881	102.7644	95.3000	90.6332	94.3644	98.7543	107.0364	118.2386	127.9800	(72)
Total internal gains													
	550.2014	548.0125	530.9774	498.4048	466.9068	438.1010	420.8440	424.1099	440.2840	469.4422	505.0187	536.1016	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.7700	11.2829	0.6300	0.8270	0.7700	43.8750	(75)

Solar gains	43.8750	89.3089	160.9062	264.2542	355.2095	378.6909	354.2576	282.4182	196.0667	109.1425	55.2061	35.8305	(83)
Total gains	594.0764	637.3214	691.8836	762.6590	822.1163	816.7919	775.1016	706.5281	636.3507	578.5847	560.2248	571.9322	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	88.2692	88.6114	88.9562	90.7216	91.0832	92.9349	92.9349	93.3143	92.1852	91.0832	90.3630	89.6541	
alpha	6.8846	6.9074	6.9304	7.0481	7.0722	7.1957	7.1957	7.2210	7.1457	7.0722	7.0242	6.9769	
util living area													
	0.9379	0.9028	0.8167	0.6471	0.4672	0.3179	0.2303	0.2631	0.4428	0.7183	0.8901	0.9465	(86)
MIT	20.6696	20.7678	20.8949	20.9800	20.9980	20.9999	21.0000	21.0000	20.9990	20.9681	20.8272	20.6497	(87)
Th 2	20.4336	20.4357	20.4377	20.4481	20.4502	20.4606	20.4606	20.4627	20.4564	20.4502	20.4460	20.4419	(88)
util rest of house													
	0.9281	0.8890	0.7955	0.6203	0.4399	0.2911	0.2021	0.2324	0.4082	0.6862	0.8728	0.9378	(89)
MIT 2	20.0595	20.1789	20.3278	20.4291	20.4485	20.4605	20.4606	20.4627	20.4557	20.4208	20.2609	20.0427	(90)
Living area fraction									fLA = Living area / (4) =			0.4021	(91)
MIT	20.3048	20.4157	20.5558	20.6506	20.6694	20.6774	20.6775	20.6787	20.6742	20.6408	20.4886	20.2868	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3048	20.4157	20.5558	20.6506	20.6694	20.6774	20.6775	20.6787	20.6742	20.6408	20.4886	20.2868	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9256	0.8885	0.8001	0.6302	0.4508	0.3019	0.2135	0.2447	0.4221	0.6975	0.8742	0.9352	(94)
Useful gains	549.9015	566.2396	553.5723	480.6358	370.6235	246.5788	165.4545	172.9114	268.6069	403.5843	489.7594	534.8477	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	683.7740	660.3173	595.8708	488.4502	371.3625	246.6099	165.4565	172.9164	268.9370	415.7229	558.7489	676.6592	(97)
Space heating kWh													
	99.6012	63.2202	31.4701	5.6263	0.5498	0.0000	0.0000	0.0000	0.0000	9.0311	49.6725	105.5078	(98a)
Space heating requirement - total per year (kWh/year)												364.6790	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	99.6012	63.2202	31.4701	5.6263	0.5498	0.0000	0.0000	0.0000	0.0000	9.0311	49.6725	105.5078	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												364.6790	
Space heating per m2											(98c) / (4) =	5.0876	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	99.6012	63.2202	31.4701	5.6263	0.5498	0.0000	0.0000	0.0000	0.0000	9.0311	49.6725	105.5078	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	99.6012	63.2202	31.4701	5.6263	0.5498	0.0000	0.0000	0.0000	0.0000	9.0311	49.6725	105.5078	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.2264	11.9464	13.2264	12.7997	13.2264	12.7997	13.2264	13.2264	12.7997	13.2264	12.7997	13.2264	(231)
Lighting	20.7503	16.6467	14.9885	10.9812	8.4822	6.9300	7.7377	10.0578	13.0641	17.1408	19.3605	21.3270	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-17.1590	-27.2559	-44.0811	-55.1768	-64.6613	-62.2021	-61.2121	-55.2791	-45.1928	-33.1010	-19.7467	-14.4640	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.3389	-7.8837	-17.8434	-30.1705	-42.3370	-43.5118	-42.8950	-34.7344	-23.7301	-12.4245	-4.7606	-2.5531	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	364.6790	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2554.7746	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	155.7302	(230a)
Total electricity for the above, kWh/year	155.7302	(231)
Electricity for lighting (calculated in Appendix L)	167.4668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-765.7149	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2476.9358	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	364.6790	16.4900	60.1356	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	16.4900	421.2823	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	155.7302	16.4900	25.6799	(249)
Energy for lighting	167.4668	16.4900	27.6153	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-499.5319	16.4900	-82.3728	
PV Unit electricity exported	-266.1831	5.5900	-14.8796	
Total			-97.2524	(252)
Total energy cost			437.4607	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.3497	(257)
SAP value		78.1210	
SAP rating (Section 12)		78	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	364.6790	0.1590	57.9688	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2554.7746	0.1413	360.9927	(264)
Space and water heating			418.9615	(265)
Pumps, fans and electric keep-hot	155.7302	0.1387	21.6017	(267)
Energy for lighting	167.4668	0.1443	24.1706	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-499.5319	0.1324	-66.1325	
PV Unit electricity exported	-266.1831	0.1231	-32.7738	
Total			-98.9063	(269)
Total CO2, kg/year			365.8275	(272)
CO2 emissions per m2			5.1000	(273)
EI value			95.7987	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	71.6800	(1b)	x 2.4000	(2b) =	172.0320	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.6800					(4)

Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 172.0320 (5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.7700	1.2357	13.3089			(27)
External Wall 1	28.6200	10.7700	17.8500	0.1400	2.4990	14.0000	249.9000	(29a)
External Roof 1	15.7000		15.7000	0.1100	1.7270	9.0000	141.3000	(30)
Total net area of external elements Aum(A, m2)			44.3200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		17.5349			(33)
Party Wall 1			41.7100	0.0000	0.0000	20.0000	834.2000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			71.6800			80.0000	5734.4000	(32d)
Party Ceiling 1			61.5400			80.0000	4923.2000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13576.0700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		189.3983 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	4.6400	0.0500	0.2320
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	21.2000	0.0700	1.4840
E18 Party wall between dwellings	5.4000	0.0600	0.3240
E16 Corner (normal)	2.7000	0.0900	0.2430
E15 Flat roof with parapet	10.1900	0.5600	5.7064
P4 Party wall - Roof (insulation at ceiling level)	1.1700	0.1200	0.1404
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	45.4400	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.8258 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	26.3607 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.5273	16.5273	16.1974	15.2074	15.0424	14.3825	14.0525	14.0525	14.7124	15.5374	15.8674	15.7024	(38)
Heat transfer coeff	42.8881	42.8881	42.5581	41.5681	41.4032	40.7432	40.4132	40.4132	41.0732	41.8981	42.2281	42.0631	(39)
Average = Sum(39)m / 12 =												41.6781	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5983	0.5983	0.5937	0.5799	0.5776	0.5684	0.5638	0.5638	0.5730	0.5845	0.5891	0.5868	(40)
HLP (average)												0.5814	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2862	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
86.0089	84.7163	82.8328	79.2291	76.5696	73.6038	71.9181	73.7873	75.8363	79.0207	82.7018	85.6793	(42a)

Hot water usage for baths

27.0226	26.6213	26.0561	25.0141	24.2338	23.3686	22.9013	23.4625	24.0735	24.9993	26.0628	26.9312	(42b)

Hot water usage for other uses

38.0431	36.6597	35.2763	33.8929	32.5095	31.1262	31.1262	32.5095	33.8929	35.2763	36.6597	38.0431	(42c)

Average daily hot water use (litres/day)	138.9361 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.0745	147.9973	144.1652	138.1361	133.3130	128.0986	125.9455	129.7594	133.8028	139.2963	145.4243	150.6536	(44)
Energy conte	239.2651	210.7461	221.5766	189.1014	179.4649	157.5122	152.3202	160.6692	164.9922	189.0238	207.1836	235.8872	(45)

Energy content (annual)	Total = Sum(45)m =	2307.7426
Distribution loss (46)m = 0.15 x (45)m		

	35.8898	31.6119	33.2365	28.3652	26.9197	23.6268	22.8480	24.1004	24.7488	28.3536	31.0775	35.3831	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)
										Total per year (kWh/year) = Sum(64)m =		2554.7746	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	96.3403	85.2334	90.4589	79.1194	76.4567	68.6160	67.4311	70.2071	71.1031	79.6351	85.1318	95.2171	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.7067	21.0560	17.1239	12.9639	9.6907	8.1813	8.8402	11.4908	15.4229	19.5829	22.8561	24.3655	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	300.2774	303.3934	295.5413	278.8252	257.7241	237.8920	224.6430	221.5270	229.3791	246.0952	267.1963	287.0284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	(71)
Water heating gains (Table 5)													
	129.4896	126.8354	121.5845	109.8881	102.7644	95.3000	90.6332	94.3644	98.7543	107.0364	118.2386	127.9800	(72)
Total internal gains													
	550.2014	548.0125	530.9774	498.4048	466.9068	438.1010	420.8440	424.1099	440.2840	469.4422	505.0187	536.1016	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.7700	10.0309	0.6300	0.8270	0.7700	39.0064	(75)

Solar gains	39.0064	84.4476	158.7276	275.0250	367.7778	382.1355	361.4694	278.9456	191.8002	102.4648	50.3815	32.6165	(83)
Total gains	589.2078	632.4601	689.7050	773.4299	834.6846	820.2364	782.3134	703.0555	632.0842	571.9070	555.4001	568.7181	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	87.9296	87.9296	88.6114	90.7216	91.0832	92.5585	93.3143	93.3143	91.8149	90.0071	89.3038	89.6541	
alpha	6.8620	6.8620	6.9074	7.0481	7.0722	7.1706	7.2210	7.2210	7.1210	7.0005	6.9536	6.9769	
util living area													
	0.9467	0.9202	0.8502	0.6854	0.5087	0.3872	0.3151	0.3563	0.5300	0.7791	0.9102	0.9545	(86)
MIT	20.6290	20.7163	20.8540	20.9693	20.9961	20.9995	20.9999	20.9998	20.9962	20.9409	20.7828	20.6083	(87)
Th 2	20.4315	20.4315	20.4357	20.4481	20.4502	20.4585	20.4627	20.4627	20.4544	20.4440	20.4398	20.4419	(88)
util rest of house													
	0.9381	0.9084	0.8318	0.6601	0.4822	0.3604	0.2873	0.3254	0.4956	0.7503	0.8954	0.9471	(89)
MIT 2	20.0079	20.1135	20.2791	20.4180	20.4468	20.4582	20.4626	20.4626	20.4514	20.3867	20.2030	19.9916	(90)
Living area fraction										fLA = Living area / (4) =		0.4021	(91)
MIT	20.2576	20.3559	20.5102	20.6397	20.6677	20.6758	20.6787	20.6786	20.6704	20.6096	20.4361	20.2396	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2576	20.3559	20.5102	20.6397	20.6677	20.6758	20.6787	20.6786	20.6704	20.6096	20.4361	20.2396	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9352	0.9067	0.8343	0.6690	0.4927	0.3712	0.2985	0.3378	0.5093	0.7591	0.8953	0.9441	(94)
Useful gains	551.0384	573.4614	575.4341	517.4227	411.2570	304.4321	233.5076	237.5095	321.9247	434.1573	497.2397	536.9015	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	701.5473	688.6045	634.5512	529.5658	412.6943	304.5896	233.5341	237.5718	323.2632	457.0899	584.2738	695.7054	(97)
Space heating kWh													
	111.9786	77.3762	43.9831	8.7430	1.0693	0.0000	0.0000	0.0000	0.0000	17.0619	62.6645	118.1501	(98a)
Space heating requirement - total per year (kWh/year)												441.0267	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	111.9786	77.3762	43.9831	8.7430	1.0693	0.0000	0.0000	0.0000	0.0000	17.0619	62.6645	118.1501	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												441.0267	
Space heating per m2											(98c) / (4) =	6.1527	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	111.9786	77.3762	43.9831	8.7430	1.0693	0.0000	0.0000	0.0000	0.0000	17.0619	62.6645	118.1501	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	111.9786	77.3762	43.9831	8.7430	1.0693	0.0000	0.0000	0.0000	0.0000	17.0619	62.6645	118.1501	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.2264	11.9464	13.2264	12.7997	13.2264	12.7997	13.2264	13.2264	12.7997	13.2264	12.7997	13.2264	(231)
Lighting	20.7503	16.6467	14.9885	10.9812	8.4822	6.9300	7.7377	10.0578	13.0641	17.1408	19.3605	21.3270	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.5542	-26.2913	-44.2435	-57.5885	-66.9459	-63.1006	-62.6205	-55.2958	-44.8961	-31.8003	-18.3940	-13.3765	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.8173	-7.2996	-17.6598	-32.4274	-45.1477	-44.7175	-44.7982	-34.7540	-23.4507	-11.4574	-4.1731	-2.2259	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												441.0267	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2554.7746	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)													
mechanical ventilation fans (SFP = 0.7420)												155.7302	(230a)
Total electricity for the above, kWh/year												155.7302	(231)
Electricity for lighting (calculated in Appendix L)												167.4668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-771.0360	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2547.9624	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	441.0267	25.1600	110.9623	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	25.1600	642.7813	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	155.7302	25.1600	39.1817	(249)
Energy for lighting	167.4668	25.1600	42.1347	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-500.1072	25.1600	-125.8270	
PV Unit electricity exported	-270.9288	5.8100	-15.7410	
Total			-141.5679	(252)
Total energy cost			693.4921	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	441.0267	0.1583	69.7947	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2554.7746	0.1413	360.9927	(264)
Space and water heating			430.7874	(265)
Pumps, fans and electric keep-hot	155.7302	0.1387	21.6017	(267)
Energy for lighting	167.4668	0.1443	24.1706	(268)
Energy saving/generation technologies				

PV Unit electricity used in dwelling	-500.1072	0.1321	-66.0593	
PV Unit electricity exported	-270.9288	0.1226	-33.2131	
Total			-99.2724	(269)
Total CO2, kg/year			377.2873	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	441.0267	1.5858	699.3875	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	1.5225	3889.6458	(278)
Space and water heating			4589.0333	(279)
Pumps, fans and electric keep-hot	155.7302	1.5128	235.5887	(281)
Energy for lighting	167.4668	1.5338	256.8662	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-500.1072	1.4880	-744.1844	
PV Unit electricity exported	-270.9288	0.4499	-121.8889	
Total			-866.0733	(283)
Total Primary energy kWh/year			4215.4150	(286)

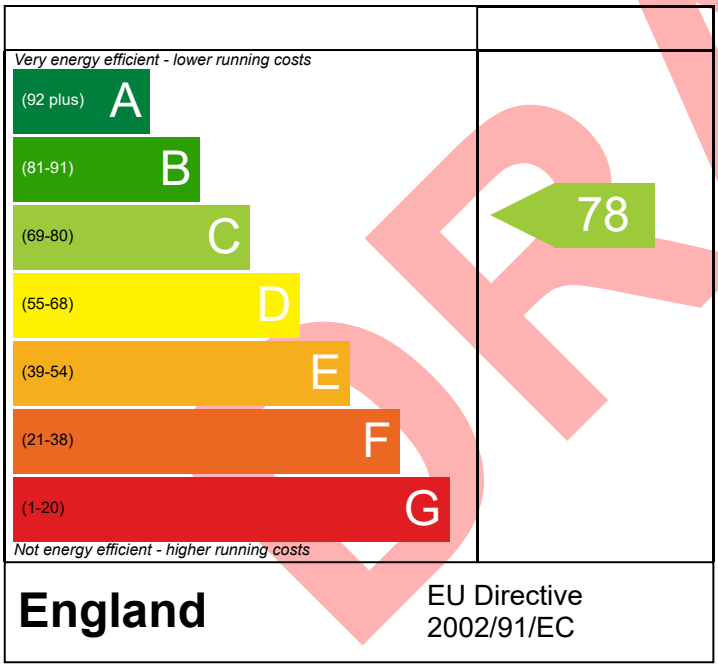
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	71.68 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

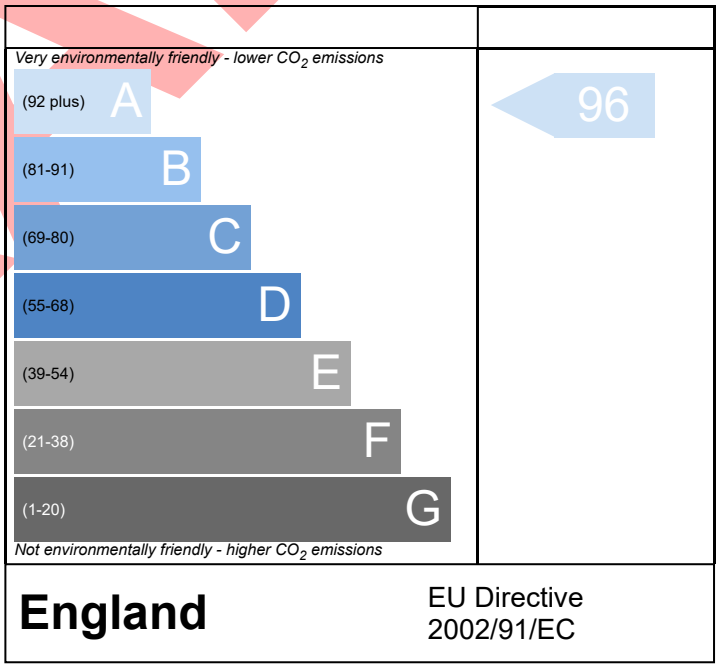
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:54

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	64 m^2
Site Reference	Unit 351 L06_Copy	Plot Reference	Unit 351 L06 _Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*14.43 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	7.49 $kgCO_2/m^2$	**OK**
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*77.89 kWh_{PE}/m^2*	
Dwelling primary energy	81.25 kWh_{PE}/m^2	**FAIL**
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*35.4 kWh/m^2*	
Dwelling fabric energy efficiency	36.6 kWh/m^2	**FAIL**

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	**OK**
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	0.11	Roof (1) (0.11)	**OK**
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	**OK**
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	22.81	0.14 **(!)**
Party wall: Party Wall (1)	37.53	0 **(!)**
Party wall: Party Wall (2)	6.68	0 **(!)**
Exposed roof: Roof (1)	26.15	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	7.18	North East	0.83	1.3
NW, Opening Type 1	10.77	North West	0.83	1.3
N, Opening Type 1	2.11	North	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	
External wall	E15: Flat roof with parapet	Calculated by person with suitable expertise	0.56	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.12	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.82 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 351 L06_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 351 L06 _Copy	**Prop Type Ref**	Unit 351 L06
Property			

SAP Rating	71 C	**DER**	7.49	**TER**	14.43
Environmental	94 A	**% DER < TER**			48.09
CO_2 Emissions (t/year)	0.48	**DFEE**	36.56	**TFEE**	35.44
Compliance Check	See BREL	**% DFEE < TFEE**			-3.17
% DPER < TPER	-4.31	**DPER**	81.25	**TPER**	77.89

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.6600 (1b)	x	2.4000 (2b)	=	152.7840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.6600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	152.7840	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.0600	1.2357	24.7890			(27)
External Wall 1	42.8700	20.0600	22.8100	0.1400	3.1934	14.0000	319.3400	(29a)
External Roof 1	26.1500		26.1500	0.1100	2.8765	9.0000	235.3500	(30)
Total net area of external elements Aum(A, m2)			69.0200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.8589			(33)
Party Wall 1			37.5300	0.0000	0.0000	20.0000	750.6000	(32)
Wall to corridor			6.6800	0.0000	0.0000	20.0000	133.6000	(32)
Party Floor 1			63.6600			80.0000	5092.8000	(32d)
Party Ceiling 1			44.8100			80.0000	3584.8000	(32b)
Internal Wall 1			123.2200			9.0000	1108.9800	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 11225.4700	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	176.3347	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	8.6400	0.0500	0.4320	
E4 Jamb	27.8400	0.0500	1.3920	
E7 Party floor between dwellings (in blocks of flats)	15.8700	0.0700	1.1109	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
E16 Corner (normal)	5.4000	0.0900	0.4860	
E15 Flat roof with parapet	15.8700	0.5600	8.8872	
P4 Party wall - Roof (insulation at ceiling level)	2.0400	0.1200	0.2448	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	30.7100	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.8769 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 43.7358 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.2548	15.0941	14.9334	14.1298	13.9691	13.1656	13.1656	13.0049	13.4870	13.9691	14.2906	14.6120	(38)

Heat transfer coeff

	58.9906	58.8299	58.6692	57.8656	57.7049	56.9014	56.9014	56.7407	57.2228	57.7049	58.0263	58.3477	(39)

Average = Sum(39)m / 12 = 57.8254

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9267	0.9241	0.9216	0.9090	0.9065	0.8938	0.8938	0.8913	0.8989	0.9065	0.9115	0.9166	(40)
HLP (average)												0.9083	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0830 (42)

Hot water usage for mixer showers

81.3240	80.1018	78.3209	74.9135	72.3989	69.5946	68.0007	69.7681	71.7056	74.7165	78.1971	81.0124	(42a)

Hot water usage for baths

25.5574	25.1778	24.6433	23.6578	22.9198	22.1016	21.6596	22.1903	22.7682	23.6438	24.6497	25.4710	(42b)

Hot water usage for other uses

35.9620	34.6543	33.3466	32.0389	30.7312	29.4235	29.4235	30.7312	32.0389	33.3466	34.6543	35.9620	(42c)

Average daily hot water use (litres/day) 131.3665 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	142.8434	139.9340	136.3109	130.6102	126.0499	121.1197	119.0838	122.6897	126.5127	131.7069	137.5011	142.4454	(44)
Energy conte	226.2290	199.2641	209.5047	178.7988	169.6874	148.9308	144.0215	151.9154	156.0028	178.7250	195.8955	223.0351	(45)
Energy content (annual)										Total = Sum(45)m =		2182.0102	
Distribution loss (46)m = 0.15 x (45)m													
	33.9344	29.8896	31.4257	26.8198	25.4531	22.3396	21.6032	22.7873	23.4004	26.8088	29.3843	33.4553	(46)

Water storage loss:

Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
									Total per year (kWh/year) = Sum(64)m =		2429.0422	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

92.0058	81.4156	86.4450	75.6938	73.2057	65.7627	64.6718	67.2965	68.1141	76.2107	81.3784	90.9438	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

20.9586	18.6152	15.1389	11.4611	8.5673	7.2329	7.8154	10.1588	13.6351	17.3128	20.2066	21.5411	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

271.7527	274.5726	267.4664	252.3383	233.2416	215.2935	203.3031	200.4831	207.5893	222.7175	241.8141	259.7622	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	(71)

Water heating gains (Table 5)

123.6637	121.1542	116.1895	105.1303	98.3948	91.3371	86.9244	90.4523	94.6030	102.4338	113.0256	122.2363	(72)

Total internal gains

507.6160	505.5831	490.0359	460.1707	431.4448	405.1046	389.2840	392.3353	407.0684	433.7051	466.2874	494.7806	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1100	10.6334	0.6300	0.8270	0.7700	8.1009	(74)
Northeast	7.1800	11.2829	0.6300	0.8270	0.7700	29.2500	(75)
Northwest	10.7700	11.2829	0.6300	0.8270	0.7700	43.8750	(81)

Solar gains	81.2259	164.3294	294.4834	482.6785	648.9369	692.0873	647.3206	515.8331	358.4067	200.3326	102.0037	66.4709	(83)
Total gains	588.8419	669.9125	784.5193	942.8492	1080.3817	1097.1918	1036.6046	908.1683	765.4751	634.0377	568.2911	561.2515	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.8590	53.0034	53.1486	53.8867	54.0368	54.7999	54.7999	54.9551	54.4920	54.0368	53.7374	53.4414	
alpha	4.5239	4.5336	4.5432	4.5924	4.6025	4.6533	4.6533	4.6637	4.6328	4.6025	4.5825	4.5628	
util living area	0.9584	0.9286	0.8511	0.6825	0.4865	0.3306	0.2413	0.2868	0.5039	0.7982	0.9308	0.9649	(86)
MIT	20.0245	20.2459	20.5753	20.8680	20.9744	20.9966	20.9994	20.9987	20.9787	20.7809	20.3541	19.9804	(87)
Th 2	20.1449	20.1470	20.1492	20.1599	20.1620	20.1727	20.1727	20.1749	20.1685	20.1620	20.1577	20.1535	(88)
util rest of house	0.9504	0.9159	0.8279	0.6463	0.4455	0.2884	0.1960	0.2356	0.4472	0.7601	0.9163	0.9580	(89)
MIT 2	19.0292	19.3034	19.6986	20.0337	20.1411	20.1706	20.1725	20.1743	20.1537	19.9533	19.4501	18.9809	(90)
Living area fraction									fLA = Living area / (4) =			0.3699	(91)
MIT	19.3974	19.6521	20.0229	20.3423	20.4493	20.4762	20.4784	20.4793	20.4589	20.2595	19.7845	19.3507	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3974	19.6521	20.0229	20.3423	20.4493	20.4762	20.4784	20.4793	20.4589	20.2595	19.7845	19.3507	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9420	0.9074	0.8242	0.6544	0.4597	0.3039	0.2128	0.2545	0.4673	0.7649	0.9088	0.9501	(94)
Useful gains	554.6688	607.8479	646.5781	616.9774	496.6531	333.4407	220.5562	231.1672	357.6911	484.9628	516.4722	533.2289	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	890.6022	867.8620	793.3783	662.1182	504.8798	334.3643	220.6861	231.4611	363.8733	557.3977	736.0364	884.0073	(97)
Space heating kWh	249.9344	174.7295	109.2194	32.5013	6.1206	0.0000	0.0000	0.0000	0.0000	53.8916	158.0862	260.9792	(98a)
Space heating requirement - total per year (kWh/year)												1045.4622	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	249.9344	174.7295	109.2194	32.5013	6.1206	0.0000	0.0000	0.0000	0.0000	53.8916	158.0862	260.9792	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1045.4622	
Space heating per m2											(98c) / (4) =	16.4226	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	249.9344	174.7295	109.2194	32.5013	6.1206	0.0000	0.0000	0.0000	0.0000	53.8916	158.0862	260.9792	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	249.9344	174.7295	109.2194	32.5013	6.1206	0.0000	0.0000	0.0000	0.0000	53.8916	158.0862	260.9792	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.0817	10.0092	11.0817	10.7242	11.0817	10.7242	11.0817	11.0817	10.7242	11.0817	10.7242	11.0817	(231)
Lighting	18.3449	14.7170	13.2510	9.7083	7.4989	6.1267	6.8408	8.8919	11.5497	15.1538	17.1162	18.8548	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.5011	-24.7980	-40.1604	-49.8447	-57.9398	-55.5822	-54.6983	-49.3462	-40.2733	-29.8957	-17.8843	-13.0486	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.5723	-6.1853	-14.4396	-25.4077	-36.4028	-37.6280	-37.0950	-30.0206	-20.4973	-10.2451	-3.7243	-1.9557	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1045.4622	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2429.0422	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	130.4775	(230a)
Total electricity for the above, kWh/year	130.4775	(231)
Electricity for lighting (calculated in Appendix L)	148.0540	(232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-675.1465	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3077.8894	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1045.4622	16.4900	172.3967	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	16.4900	400.5491	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	130.4775	16.4900	21.5157	(249)
Energy for lighting	148.0540	16.4900	24.4141	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-448.9727	16.4900	-74.0356	
PV Unit electricity exported	-226.1738	5.5900	-12.6431	
Total			-86.6787	(252)
Total energy cost			532.1969	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.7632	(257)
SAP value	71.4183	
SAP rating (Section 12)	71	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1045.4622	0.1574	164.6021	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2429.0422	0.1413	343.1917	(264)
Space and water heating			507.7937	(265)
Pumps, fans and electric keep-hot	130.4775	0.1387	18.0988	(267)
Energy for lighting	148.0540	0.1443	21.3688	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-448.9727	0.1325	-59.4895	
PV Unit electricity exported	-226.1738	0.1223	-27.6661	
Total			-87.1556	(269)
Total CO2, kg/year			460.1057	(272)
CO2 emissions per m2			7.2300	(273)
EI value			94.3260	
EI rating			94	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.6600	(1b)	x 2.4000	(2b) =	152.7840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.6600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		152.7840	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 = 0.0000	(6a)
Number of open flues	0 * 20 = 0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000	(6d)
Number of flues attached to other heater	0 * 35 = 0.0000	(6e)
Number of blocked chimneys	0 * 20 = 0.0000	(6f)
Number of intermittent extract fans	0 * 10 = 0.0000	(7a)
Number of passive vents	0 * 10 = 0.0000	(7b)
Number of flueless gas fires	0 * 40 = 0.0000	(7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000	(8)
Pressure test	Yes	
Pressure Test Method	Blower Door	

Measured/design AP50												3.0000	(17)
Infiltration rate												0.1500	(18)
Number of sides sheltered												2	(19)
Shelter factor								(20) = 1 - [0.075 x (19)] =				0.8500	(20)
Infiltration rate adjusted to include shelter factor								(21) = (18) x (20) =				0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery		
If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.0600	1.2357	24.7890			(27)
External Wall 1	42.8700	20.0600	22.8100	0.1400	3.1934	14.0000	319.3400	(29a)
External Roof 1	26.1500		26.1500	0.1100	2.8765	9.0000	235.3500	(30)
Total net area of external elements Aum(A, m2)			69.0200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.8589			(33)
Party Wall 1			37.5300	0.0000	0.0000	20.0000	750.6000	(32)
Wall to corridor			6.6800	0.0000	0.0000	20.0000	133.6000	(32)
Party Floor 1			63.6600			80.0000	5092.8000	(32d)
Party Ceiling 1			44.8100			80.0000	3584.8000	(32b)
Internal Wall 1			123.2200			9.0000	1108.9800	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 11225.4700	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	176.3347	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.6400	0.0500	0.4320
E4 Jamb	27.8400	0.0500	1.3920
E7 Party floor between dwellings (in blocks of flats)	15.8700	0.0700	1.1109
E18 Party wall between dwellings	5.4000	0.0600	0.3240
E16 Corner (normal)	5.4000	0.0900	0.4860
E15 Flat roof with parapet	15.8700	0.5600	8.8872
P4 Party wall - Roof (insulation at ceiling level)	2.0400	0.1200	0.2448
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	30.7100	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.8769	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	43.7358	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.4155	15.4155	15.0941	14.1298	13.9691	13.3263	13.0049	13.0049	13.6477	14.4513	14.7727	14.6120	(38)
Heat transfer coeff	59.1513	59.1513	58.8299	57.8656	57.7049	57.0621	56.7407	56.7407	57.3835	58.1870	58.5085	58.3477	(39)
Average = Sum(39)m / 12 =												57.9728	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9292	0.9292	0.9241	0.9090	0.9065	0.8964	0.8913	0.8913	0.9014	0.9140	0.9191	0.9166	(40)
HLP (average)												0.9107	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0830	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	81.3240	80.1018	78.3209	74.9135	72.3989	69.5946	68.0007	69.7681	71.7056	74.7165	78.1971	81.0124	(42a)
Hot water usage for baths	25.5574	25.1778	24.6433	23.6578	22.9198	22.1016	21.6596	22.1903	22.7682	23.6438	24.6497	25.4710	(42b)
Hot water usage for other uses	35.9620	34.6543	33.3466	32.0389	30.7312	29.4235	29.4235	30.7312	32.0389	33.3466	34.6543	35.9620	(42c)
Average daily hot water use (litres/day)												131.3665	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	142.8434	139.9340	136.3109	130.6102	126.0499	121.1197	119.0838	122.6897	126.5127	131.7069	137.5011	142.4454	(44)
Energy conte	226.2290	199.2641	209.5047	178.7988	169.6874	148.9308	144.0215	151.9154	156.0028	178.7250	195.8955	223.0351	(45)
Energy content (annual)										Total = Sum(45)m =		2182.0102	
Distribution loss (46)m = 0.15 x (45)m	33.9344	29.8896	31.4257	26.8198	25.4531	22.3396	21.6032	22.7873	23.4004	26.8088	29.3843	33.4553	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
										Total per year (kWh/year) = Sum(64)m =		2429.0422	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

	92.0058	81.4156	86.4450	75.6938	73.2057	65.7627	64.6718	67.2965	68.1141	76.2107	81.3784	90.9438 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	20.9586	18.6152	15.1389	11.4611	8.5673	7.2329	7.8154	10.1588	13.6351	17.3128	20.2066	21.5411 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	271.7527	274.5726	267.4664	252.3383	233.2416	215.2935	203.3031	200.4831	207.5893	222.7175	241.8141	259.7622 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201 (71)

Water heating gains (Table 5)

	123.6637	121.1542	116.1895	105.1303	98.3948	91.3371	86.9244	90.4523	94.6030	102.4338	113.0256	122.2363 (72)

Total internal gains

	507.6160	505.5831	490.0359	460.1707	431.4448	405.1046	389.2840	392.3353	407.0684	433.7051	466.2874	494.7806 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1100	9.5462	0.6300	0.8270	0.7700	7.2726	(74)
Northeast	7.1800	10.0309	0.6300	0.8270	0.7700	26.0043	(75)
Northwest	10.7700	10.0309	0.6300	0.8270	0.7700	39.0064	(81)

Solar gains	72.2833	155.5005	290.6031	502.3813	671.8495	698.3105	660.4378	509.4851	350.6863	188.1893	93.1748	60.5706	(83)
Total gains	579.8993	661.0836	780.6390	962.5521	1103.2943	1103.4151	1049.7218	901.8204	757.7547	621.8944	559.4622	555.3512	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.7154	52.7154	53.0034	53.8867	54.0368	54.6455	54.9551	54.9551	54.3394	53.5890	53.2946	53.4414	
alpha	4.5144	4.5144	4.5336	4.5924	4.6025	4.6430	4.6637	4.6637	4.6226	4.5726	4.5530	4.5628	
util living area	0.9637	0.9394	0.8745	0.7117	0.5238	0.3998	0.3285	0.3871	0.5930	0.8426	0.9419	0.9695	(86)
MIT	19.9513	20.1502	20.4820	20.8301	20.9617	20.9908	20.9969	20.9937	20.9506	20.6895	20.2671	19.9053	(87)
Th 2	20.1428	20.1428	20.1470	20.1599	20.1620	20.1706	20.1749	20.1749	20.1663	20.1556	20.1513	20.1535	(88)
util rest of house	0.9567	0.9286	0.8548	0.6787	0.4849	0.3585	0.2845	0.3367	0.5406	0.8114	0.9297	0.9636	(89)
MIT 2	18.9359	19.1819	19.5859	19.9921	20.1290	20.1639	20.1730	20.1710	20.1272	19.8460	19.3384	18.8863	(90)
Living area fraction									fLA = Living area / (4) =			0.3699	(91)
MIT	19.3116	19.5401	19.9174	20.3021	20.4371	20.4698	20.4778	20.4754	20.4318	20.1580	19.6820	19.2633	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3116	19.5401	19.9174	20.3021	20.4371	20.4698	20.4778	20.4754	20.4318	20.1580	19.6820	19.2633	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9485	0.9197	0.8490	0.6845	0.4978	0.3734	0.3007	0.3552	0.5577	0.8115	0.9217	0.9559	(94)
Useful gains	550.0568	608.0231	662.7369	658.8601	549.2359	412.0614	315.6643	320.3203	422.5769	504.6787	515.6447	530.8829	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	911.6134	901.4719	842.2916	717.6573	561.8761	414.8293	316.4896	322.0248	437.9387	608.5216	765.4063	908.0810	(97)
Space heating kWh	268.9981	197.1975	133.5887	42.3340	9.4043	0.0000	0.0000	0.0000	0.0000	77.2591	179.8284	280.6354	(98a)
Space heating requirement - total per year (kWh/year)												1189.2456	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	268.9981	197.1975	133.5887	42.3340	9.4043	0.0000	0.0000	0.0000	0.0000	77.2591	179.8284	280.6354	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1189.2456	
Space heating per m2											(98c) / (4) =	18.6812	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	268.9981	197.1975	133.5887	42.3340	9.4043	0.0000	0.0000	0.0000	0.0000	77.2591	179.8284	280.6354	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	268.9981	197.1975	133.5887	42.3340	9.4043	0.0000	0.0000	0.0000	0.0000	77.2591	179.8284	280.6354	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)

Space heating fuel (secondary)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.0817	10.0092	11.0817	10.7242	11.0817	10.7242	11.0817	11.0817	10.7242	11.0817	10.7242	11.0817	(231)
Lighting	18.3449	14.7170	13.2510	9.7083	7.4989	6.1267	6.8408	8.8919	11.5497	15.1538	17.1162	18.8548	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.0357	-23.9196	-40.4064	-52.2196	-60.1145	-56.3926	-55.9689	-49.3612	-40.0071	-28.8283	-16.6526	-12.0578	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.1628	-5.6981	-14.1750	-27.1494	-38.7208	-38.6728	-38.7444	-30.0375	-20.2557	-9.3130	-3.2454	-1.6991	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1189.2456	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2429.0422	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	130.4775	(230a)
Total electricity for the above, kWh/year	130.4775	(231)
Electricity for lighting (calculated in Appendix L)	148.0540	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-679.8382	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3216.9810	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1189.2456	25.1600	299.2142	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	25.1600	611.1470	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	130.4775	25.1600	32.8281	(249)
Energy for lighting	148.0540	25.1600	37.2504	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-449.9644	25.1600	-113.2110	
PV Unit electricity exported	-229.8739	5.8100	-13.3557	
Total			-126.5667	(252)
Total energy cost			853.8730	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1189.2456	0.1569	186.5374	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2429.0422	0.1413	343.1917	(264)
Space and water heating			529.7291	(265)
Pumps, fans and electric keep-hot	130.4775	0.1387	18.0988	(267)
Energy for lighting	148.0540	0.1443	21.3688	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-449.9644	0.1322	-59.4893	
PV Unit electricity exported	-229.8739	0.1218	-27.9898	
Total			-87.4791	(269)
Total CO2, kg/year			481.7176	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1189.2456	1.5807	1879.8025	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	1.5224	3698.0874	(278)
Space and water heating			5577.8899	(279)
Pumps, fans and electric keep-hot	130.4775	1.5128	197.3864	(281)
Energy for lighting	148.0540	1.5338	227.0901	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-449.9644	1.4885	-669.7715	
PV Unit electricity exported	-229.8739	0.4468	-102.7080	

Total	-772.4795 (283)
Total Primary energy kWh/year	5229.8870 (286)

SAP 10 EPC IMPROVEMENTS

Unit 351 L06 _Copy

Current energy efficiency rating:	C 71
Current environmental impact rating:	A 94

N Solar water heating	Not applicable
U Solar photovoltaic panels	Not applicable
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating:	C 71
Potential environmental impact rating:	A 94

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£980	£980	£0
Space heating	£332	£332	£0
Water heating	£611	£611	£0
Lighting	£37	£37	£0
Generated (PV)	-£127	-£127	£0
Total cost of fuels	£853	£853	£0
Total cost of uses	£853	£853	£0
Delivered energy	51 kWh/m²	51 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.5 tonnes	0.0 tonnes
CO2 emissions per m²	8 kg/m²	8 kg/m²	0 kg/m²
Primary energy	82 kWh/m²	82 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.6600 (1b)	x	2.4000 (2b)	=	152.7840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.6600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	152.7840	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												72.0000	(23c)
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.0600	1.2357	24.7890			(27)
External Wall 1	42.8700	20.0600	22.8100	0.1400	3.1934	14.0000	319.3400	(29a)
External Roof 1	26.1500		26.1500	0.1100	2.8765	9.0000	235.3500	(30)
Total net area of external elements Aum(A, m2)			69.0200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.8589			(33)
Party Wall 1			37.5300	0.0000	0.0000	20.0000	750.6000	(32)
Wall to corridor			6.6800	0.0000	0.0000	20.0000	133.6000	(32)
Party Floor 1			63.6600			80.0000	5092.8000	(32d)
Party Ceiling 1			44.8100			80.0000	3584.8000	(32b)
Internal Wall 1			123.2200			9.0000	1108.9800	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	11225.4700	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		176.3347	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.6400	0.0500	0.4320
E4 Jamb	27.8400	0.0500	1.3920
E7 Party floor between dwellings (in blocks of flats)	15.8700	0.0700	1.1109
E18 Party wall between dwellings	5.4000	0.0600	0.3240
E16 Corner (normal)	5.4000	0.0900	0.4860
E15 Flat roof with parapet	15.8700	0.5600	8.8872
P4 Party wall - Roof (insulation at ceiling level)	2.0400	0.1200	0.2448
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	30.7100	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		12.8769	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	43.7358	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.2548	15.0941	14.9334	14.1298	13.9691	13.1656	13.1656	13.0049	13.4870	13.9691	14.2906	14.6120	(38)
Heat transfer coeff	58.9906	58.8299	58.6692	57.8656	57.7049	56.9014	56.9014	56.7407	57.2228	57.7049	58.0263	58.3477	(39)
Average = Sum(39)m / 12 =												57.8254	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9267	0.9241	0.9216	0.9090	0.9065	0.8938	0.8938	0.8913	0.8989	0.9065	0.9115	0.9166	(40)
HLP (average)												0.9083	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0830	(42)
Hot water usage for mixer showers	81.3240	80.1018	78.3209	74.9135	72.3989	69.5946	68.0007	69.7681	71.7056	74.7165	78.1971	81.0124	(42a)
Hot water usage for baths	25.5574	25.1778	24.6433	23.6578	22.9198	22.1016	21.6596	22.1903	22.7682	23.6438	24.6497	25.4710	(42b)
Hot water usage for other uses	35.9620	34.6543	33.3466	32.0389	30.7312	29.4235	29.4235	30.7312	32.0389	33.3466	34.6543	35.9620	(42c)
Average daily hot water use (litres/day)												131.3665	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	142.8434	139.9340	136.3109	130.6102	126.0499	121.1197	119.0838	122.6897	126.5127	131.7069	137.5011	142.4454	(44)
Energy conte	226.2290	199.2641	209.5047	178.7988	169.6874	148.9308	144.0215	151.9154	156.0028	178.7250	195.8955	223.0351	(45)
Energy content (annual)										Total = Sum(45)m =		2182.0102	
Distribution loss (46)m = 0.15 x (45)m	33.9344	29.8896	31.4257	26.8198	25.4531	22.3396	21.6032	22.7873	23.4004	26.8088	29.3843	33.4553	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
										Total per year (kWh/year) = Sum(64)m =		2429.0422	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	92.0058	81.4156	86.4450	75.6938	73.2057	65.7627	64.6718	67.2965	68.1141	76.2107	81.3784	90.9438	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.9586	18.6152	15.1389	11.4611	8.5673	7.2329	7.8154	10.1588	13.6351	17.3128	20.2066	21.5411	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	271.7527	274.5726	267.4664	252.3383	233.2416	215.2935	203.3031	200.4831	207.5893	222.7175	241.8141	259.7622	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	(71)
Water heating gains (Table 5)													
	123.6637	121.1542	116.1895	105.1303	98.3948	91.3371	86.9244	90.4523	94.6030	102.4338	113.0256	122.2363	(72)
Total internal gains													
	507.6160	505.5831	490.0359	460.1707	431.4448	405.1046	389.2840	392.3353	407.0684	433.7051	466.2874	494.7806	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1100	10.6334	0.6300	0.8270	0.7700	8.1009	(74)
Northeast	7.1800	11.2829	0.6300	0.8270	0.7700	29.2500	(75)
Northwest	10.7700	11.2829	0.6300	0.8270	0.7700	43.8750	(81)

Solar gains	81.2259	164.3294	294.4834	482.6785	648.9369	692.0873	647.3206	515.8331	358.4067	200.3326	102.0037	66.4709	(83)
Total gains	588.8419	669.9125	784.5193	942.8492	1080.3817	1097.1918	1036.6046	908.1683	765.4751	634.0377	568.2911	561.2515	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.8590	53.0034	53.1486	53.8867	54.0368	54.7999	54.7999	54.9551	54.4920	54.0368	53.7374	53.4414	
alpha	4.5239	4.5336	4.5432	4.5924	4.6025	4.6533	4.6533	4.6637	4.6328	4.6025	4.5825	4.5628	
util living area													
	0.9584	0.9286	0.8511	0.6825	0.4865	0.3306	0.2413	0.2868	0.5039	0.7982	0.9308	0.9649	(86)
MIT	20.0245	20.2459	20.5753	20.8680	20.9744	20.9966	20.9994	20.9987	20.9787	20.7809	20.3541	19.9804	(87)
Th 2	20.1449	20.1470	20.1492	20.1599	20.1620	20.1727	20.1727	20.1749	20.1685	20.1620	20.1577	20.1535	(88)
util rest of house													
	0.9504	0.9159	0.8279	0.6463	0.4455	0.2884	0.1960	0.2356	0.4472	0.7601	0.9163	0.9580	(89)
MIT 2	19.0292	19.3034	19.6986	20.0337	20.1411	20.1706	20.1725	20.1743	20.1537	19.9533	19.4501	18.9809	(90)
Living area fraction									fLA = Living area / (4) =			0.3699	(91)
MIT	19.3974	19.6521	20.0229	20.3423	20.4493	20.4762	20.4784	20.4793	20.4589	20.2595	19.7845	19.3507	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3974	19.6521	20.0229	20.3423	20.4493	20.4762	20.4784	20.4793	20.4589	20.2595	19.7845	19.3507	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9420	0.9074	0.8242	0.6544	0.4597	0.3039	0.2128	0.2545	0.4673	0.7649	0.9088	0.9501	(94)
Useful gains	554.6688	607.8479	646.5781	616.9774	496.6531	333.4407	220.5562	231.1672	357.6911	484.9628	516.4722	533.2289	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	890.6022	867.8620	793.3783	662.1182	504.8798	334.3643	220.6861	231.4611	363.8733	557.3977	736.0364	884.0073	(97)
Space heating kWh													
	249.9344	174.7295	109.2194	32.5013	6.1206	0.0000	0.0000	0.0000	0.0000	53.8916	158.0862	260.9792	(98a)
Space heating requirement - total per year (kWh/year)												1045.4622	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	249.9344	174.7295	109.2194	32.5013	6.1206	0.0000	0.0000	0.0000	0.0000	53.8916	158.0862	260.9792	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1045.4622	
Space heating per m2											(98c) / (4) =	16.4226	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	249.9344	174.7295	109.2194	32.5013	6.1206	0.0000	0.0000	0.0000	0.0000	53.8916	158.0862	260.9792	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	249.9344	174.7295	109.2194	32.5013	6.1206	0.0000	0.0000	0.0000	0.0000	53.8916	158.0862	260.9792	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.0817	10.0092	11.0817	10.7242	11.0817	10.7242	11.0817	11.0817	10.7242	11.0817	10.7242	11.0817	(231)
Lighting	18.3449	14.7170	13.2510	9.7083	7.4989	6.1267	6.8408	8.8919	11.5497	15.1538	17.1162	18.8548	(232)

Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-15.5011	-24.7980	-40.1604	-49.8447	-57.9398	-55.5822	-54.6983	-49.3462	-40.2733	-29.8957	-17.8843	-13.0486 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.5723	-6.1853	-14.4396	-25.4077	-36.4028	-37.6280	-37.0950	-30.0206	-20.4973	-10.2451	-3.7243	-1.9557 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1045.4622	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2429.0422	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	130.4775	(230a)
Total electricity for the above, kWh/year	130.4775	(231)
Electricity for lighting (calculated in Appendix L)	148.0540	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-675.1465	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3077.8894	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1045.4622	16.4900	172.3967	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	16.4900	400.5491	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	130.4775	16.4900	21.5157	(249)
Energy for lighting	148.0540	16.4900	24.4141	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-448.9727	16.4900	-74.0356	
PV Unit electricity exported	-226.1738	5.5900	-12.6431	
Total			-86.6787	(252)
Total energy cost			532.1969	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.7632	(257)
SAP value		71.4183	
SAP rating (Section 12)		71	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1045.4622	0.1574	164.6021	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2429.0422	0.1413	343.1917	(264)
Space and water heating			507.7937	(265)
Pumps, fans and electric keep-hot	130.4775	0.1387	18.0988	(267)
Energy for lighting	148.0540	0.1443	21.3688	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-448.9727	0.1325	-59.4895	
PV Unit electricity exported	-226.1738	0.1223	-27.6661	
Total			-87.1556	(269)
Total CO2, kg/year			460.1057	(272)
CO2 emissions per m2			7.2300	(273)
EI value			94.3260	
EI rating			94	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.6600 (1b)	x	2.4000 (2b)	=	152.7840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.6600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	152.7840	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.0600	1.2357	24.7890			(27)
External Wall 1	42.8700	20.0600	22.8100	0.1400	3.1934	14.0000	319.3400	(29a)
External Roof 1	26.1500		26.1500	0.1100	2.8765	9.0000	235.3500	(30)
Total net area of external elements Aum(A, m2)			69.0200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.8589			(33)
Party Wall 1			37.5300	0.0000	0.0000	20.0000	750.6000	(32)
Wall to corridor			6.6800	0.0000	0.0000	20.0000	133.6000	(32)
Party Floor 1			63.6600			80.0000	5092.8000	(32d)
Party Ceiling 1			44.8100			80.0000	3584.8000	(32b)
Internal Wall 1			123.2200			9.0000	1108.9800	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 11225.4700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	176.3347 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.6400	0.0500	0.4320
E4 Jamb	27.8400	0.0500	1.3920
E7 Party floor between dwellings (in blocks of flats)	15.8700	0.0700	1.1109
E18 Party wall between dwellings	5.4000	0.0600	0.3240
E16 Corner (normal)	5.4000	0.0900	0.4860
E15 Flat roof with parapet	15.8700	0.5600	8.8872
P4 Party wall - Roof (insulation at ceiling level)	2.0400	0.1200	0.2448
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	30.7100	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		12.8769 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	43.7358 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.4155	15.4155	15.0941	14.1298	13.9691	13.3263	13.0049	13.0049	13.6477	14.4513	14.7727	14.6120	(38)
Heat transfer coeff	59.1513	59.1513	58.8299	57.8656	57.7049	57.0621	56.7407	56.7407	57.3835	58.1870	58.5085	58.3477	(39)

Average = Sum(39)m / 12 =	57.9728

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9292	0.9292	0.9241	0.9090	0.9065	0.8964	0.8913	0.8913	0.9014	0.9140	0.9191	0.9166	(40)
HLP (average)												0.9107	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0830 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	81.3240	80.1018	78.3209	74.9135	72.3989	69.5946	68.0007	69.7681	71.7056	74.7165	78.1971	81.0124	(42a)
Hot water usage for baths	25.5574	25.1778	24.6433	23.6578	22.9198	22.1016	21.6596	22.1903	22.7682	23.6438	24.6497	25.4710	(42b)
Hot water usage for other uses	35.9620	34.6543	33.3466	32.0389	30.7312	29.4235	29.4235	30.7312	32.0389	33.3466	34.6543	35.9620	(42c)

Average daily hot water use (litres/day)	131.3665 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	142.8434	139.9340	136.3109	130.6102	126.0499	121.1197	119.0838	122.6897	126.5127	131.7069	137.5011	142.4454	(44)
Energy conte	226.2290	199.2641	209.5047	178.7988	169.6874	148.9308	144.0215	151.9154	156.0028	178.7250	195.8955	223.0351	(45)
Energy content (annual)										Total = Sum(45)m =		2182.0102	
Distribution loss (46)m = 0.15 x (45)m													
	33.9344	29.8896	31.4257	26.8198	25.4531	22.3396	21.6032	22.7873	23.4004	26.8088	29.3843	33.4553	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
										Total per year (kWh/year) = Sum(64)m =		2429.0422	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						0.0000	(64a)
Heat gains from water heating, kWh/month													
	92.0058	81.4156	86.4450	75.6938	73.2057	65.7627	64.6718	67.2965	68.1141	76.2107	81.3784	90.9438	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.9586	18.6152	15.1389	11.4611	8.5673	7.2329	7.8154	10.1588	13.6351	17.3128	20.2066	21.5411	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	271.7527	274.5726	267.4664	252.3383	233.2416	215.2935	203.3031	200.4831	207.5893	222.7175	241.8141	259.7622	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	(71)
Water heating gains (Table 5)													
	123.6637	121.1542	116.1895	105.1303	98.3948	91.3371	86.9244	90.4523	94.6030	102.4338	113.0256	122.2363	(72)
Total internal gains													
	507.6160	505.5831	490.0359	460.1707	431.4448	405.1046	389.2840	392.3353	407.0684	433.7051	466.2874	494.7806	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1100	9.5462	0.6300	0.8270	0.7700	7.2726	(74)
Northeast	7.1800	10.0309	0.6300	0.8270	0.7700	26.0043	(75)
Northwest	10.7700	10.0309	0.6300	0.8270	0.7700	39.0064	(81)

Solar gains	72.2833	155.5005	290.6031	502.3813	671.8495	698.3105	660.4378	509.4851	350.6863	188.1893	93.1748	60.5706	(83)
Total gains	579.8993	661.0836	780.6390	962.5521	1103.2943	1103.4151	1049.7218	901.8204	757.7547	621.8944	559.4622	555.3512	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.7154	52.7154	53.0034	53.8867	54.0368	54.6455	54.9551	54.9551	54.3394	53.5890	53.2946	53.4414	
alpha	4.5144	4.5144	4.5336	4.5924	4.6025	4.6430	4.6637	4.6637	4.6226	4.5726	4.5530	4.5628	
util living area													
	0.9637	0.9394	0.8745	0.7117	0.5238	0.3998	0.3285	0.3871	0.5930	0.8426	0.9419	0.9695	(86)
MIT	19.9513	20.1502	20.4820	20.8301	20.9617	20.9908	20.9969	20.9937	20.9506	20.6895	20.2671	19.9053	(87)
Th 2	20.1428	20.1428	20.1470	20.1599	20.1620	20.1706	20.1749	20.1749	20.1663	20.1556	20.1513	20.1535	(88)
util rest of house													
	0.9567	0.9286	0.8548	0.6787	0.4849	0.3585	0.2845	0.3367	0.5406	0.8114	0.9297	0.9636	(89)
MIT 2	18.9359	19.1819	19.5859	19.9921	20.1290	20.1639	20.1730	20.1710	20.1272	19.8460	19.3384	18.8863	(90)
Living area fraction									fLA = Living area / (4) =			0.3699	(91)
MIT	19.3116	19.5401	19.9174	20.3021	20.4371	20.4698	20.4778	20.4754	20.4318	20.1580	19.6820	19.2633	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3116	19.5401	19.9174	20.3021	20.4371	20.4698	20.4778	20.4754	20.4318	20.1580	19.6820	19.2633	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9485	0.9197	0.8490	0.6845	0.4978	0.3734	0.3007	0.3552	0.5577	0.8115	0.9217	0.9559	(94)
Useful gains	550.0568	608.0231	662.7369	658.8601	549.2359	412.0614	315.6643	320.3203	422.5769	504.6787	515.6447	530.8829	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	911.6134	901.4719	842.2916	717.6573	561.8761	414.8293	316.4896	322.0248	437.9387	608.5216	765.4063	908.0810	(97)
Space heating kWh													
	268.9981	197.1975	133.5887	42.3340	9.4043	0.0000	0.0000	0.0000	0.0000	77.2591	179.8284	280.6354	(98a)
Space heating requirement - total per year (kWh/year)												1189.2456	
Solar heating kWh													

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)											0.0000	
Space heating kWh												
	268.9981	197.1975	133.5887	42.3340	9.4043	0.0000	0.0000	0.0000	0.0000	77.2591	179.8284	280.6354 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)											1189.2456	
Space heating per m2										(98c) / (4) =	18.6812	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)											0.0000	(201)
Fraction of space heat from main system(s)											1.0000	(202)
Efficiency of main space heating system 1 (in %)											100.0000	(206)
Efficiency of main space heating system 2 (in %)											0.0000	(207)
Efficiency of secondary/supplementary heating system, %											0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	268.9981	197.1975	133.5887	42.3340	9.4043	0.0000	0.0000	0.0000	0.0000	77.2591	179.8284	280.6354	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	268.9981	197.1975	133.5887	42.3340	9.4043	0.0000	0.0000	0.0000	0.0000	77.2591	179.8284	280.6354	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.0817	10.0092	11.0817	10.7242	11.0817	10.7242	11.0817	11.0817	10.7242	11.0817	10.7242	11.0817	(231)
Lighting	18.3449	14.7170	13.2510	9.7083	7.4989	6.1267	6.8408	8.8919	11.5497	15.1538	17.1162	18.8548	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.0357	-23.9196	-40.4064	-52.2196	-60.1145	-56.3926	-55.9689	-49.3612	-40.0071	-28.8283	-16.6526	-12.0578	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.1628	-5.6981	-14.1750	-27.1494	-38.7208	-38.6728	-38.7444	-30.0375	-20.2557	-9.3130	-3.2454	-1.6991	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1											1189.2456		(211)
Space heating fuel - main system 2											0.0000		(213)
Space heating fuel - secondary											0.0000		(215)
Efficiency of water heater											100.0000		
Water heating fuel used											2429.0422		(219)
Space cooling fuel											0.0000		(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)													
mechanical ventilation fans (SFP = 0.7000)											130.4775		(230a)
Total electricity for the above, kWh/year											130.4775		(231)
Electricity for lighting (calculated in Appendix L)											148.0540		(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation											-679.8382		(233)
Wind generation											0.0000		(234)
Hydro-electric generation (Appendix N)											0.0000		(235a)
Electricity generated - Micro CHP (Appendix N)											0.0000		(235)
Appendix Q - special features													
Energy saved or generated											-0.0000		(236)
Energy used											0.0000		(237)
Total delivered energy for all uses											3216.9810		(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1189.2456	25.1600	299.2142	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	25.1600	611.1470	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	130.4775	25.1600	32.8281	(249)
Energy for lighting	148.0540	25.1600	37.2504	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-449.9644	25.1600	-113.2110	
PV Unit electricity exported	-229.8739	5.8100	-13.3557	
Total			-126.5667	(252)
Total energy cost			853.8730	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	

Space heating - main system 1	1189.2456	0.1569	186.5374	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2429.0422	0.1413	343.1917	(264)
Space and water heating			529.7291	(265)
Pumps, fans and electric keep-hot	130.4775	0.1387	18.0988	(267)
Energy for lighting	148.0540	0.1443	21.3688	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-449.9644	0.1322	-59.4893	
PV Unit electricity exported	-229.8739	0.1218	-27.9898	
Total			-87.4791	(269)
Total CO2, kg/year			481.7176	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1189.2456	1.5807	1879.8025	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	1.5224	3698.0874	(278)
Space and water heating			5577.8899	(279)
Pumps, fans and electric keep-hot	130.4775	1.5128	197.3864	(281)
Energy for lighting	148.0540	1.5338	227.0901	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-449.9644	1.4885	-669.7715	
PV Unit electricity exported	-229.8739	0.4468	-102.7080	
Total			-772.4795	(283)
Total Primary energy kWh/year			5229.8870	(286)

Predicted Energy Assessment

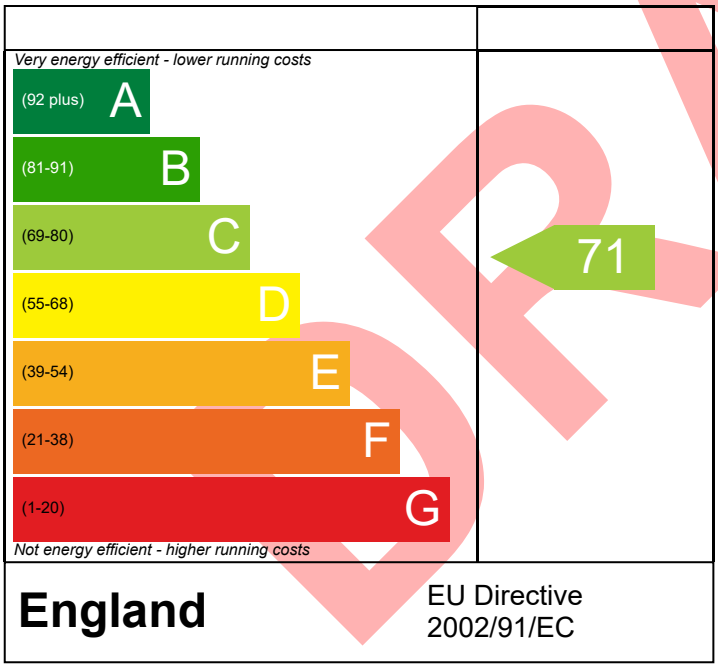
elmhurst energy

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	63.66 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

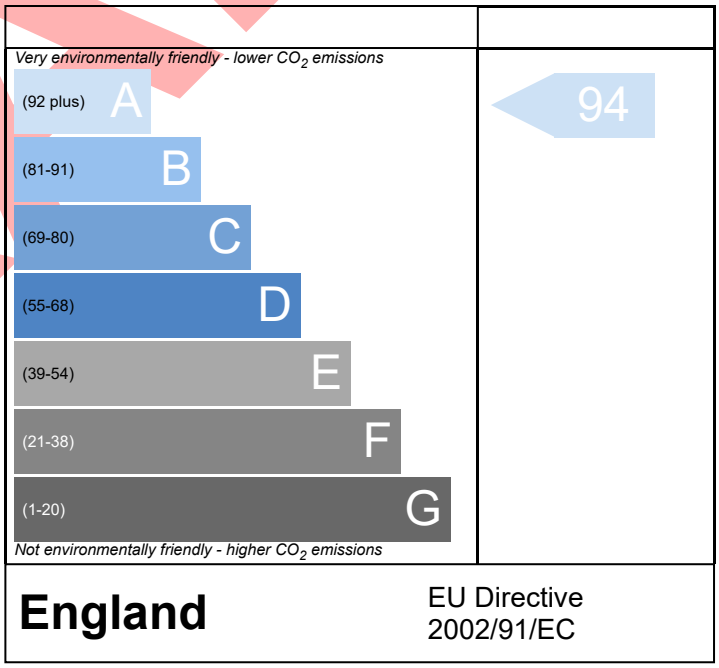
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:56

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	68 m^2
Site Reference	Unit 352 L06 _Copy	Plot Reference	Unit 352 L06_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*12.67 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	6.11 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*68.34 kWh_{PE}/m^2*	
Dwelling primary energy	67.25 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*29.0 kWh/m^2*	
Dwelling fabric energy efficiency	27.7 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	26.26	0.14 **(!)**
Party wall: Party Wall (1)	14.85	0 **(!)**
Party wall: Party Wall (2)	29.36	0 **(!)**
Exposed roof: Roof (1)	16.85	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	7.18	South West	0.83	1.3
NW, Opening Type 1	10.77	North West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	
External wall	E15: Flat roof with parapet	Calculated by person with suitable expertise	0.56	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.12	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.88 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 352 L06 _Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 352 L06_Copy	**Prop Type Ref**	Unit 352 L06
Property			

SAP Rating	75 C	**DER**	6.11	**TER**	12.67
Environmental	95 A	**% DER < TER**			51.78
CO_2 Emissions (t/year)	0.42	**DFEE**	27.73	**TFEE**	28.99
Compliance Check	See BREL	**% DFEE < TFEE**			4.33
% DPER < TPER	1.59	**DPER**	67.25	**TPER**	68.34

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	68.3100 (1b)	x	2.4000 (2b)	=	163.9440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.3100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	163.9440	(5)

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2. Ventilation rate

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	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			17.9500	1.2357	22.1816			(27)
External Wall 1	44.2100	17.9500	26.2600	0.1400	3.6764	14.0000	367.6400	(29a)
External Roof 1	16.8500		16.8500	0.1100	1.8535	9.0000	151.6500	(30)
Total net area of external elements Aum(A, m2)			61.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.7115			(33)
Party Wall 1			14.8500	0.0000	0.0000	20.0000	297.0000	(32)
Wall to corridor			29.3600	0.0000	0.0000	20.0000	587.2000	(32)
Party Floor 1			68.3100			80.0000	5464.8000	(32d)
Party Ceiling 1			52.0200			80.0000	4161.6000	(32b)
Internal Wall 1			98.7600			9.0000	888.8400	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	11918.7300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		174.4800 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	7.7300	0.0500	0.3865		
E4 Jamb	23.2000	0.0500	1.1600		
E7 Party floor between dwellings (in blocks of flats)	20.3600	0.0700	1.4252		
E18 Party wall between dwellings	2.7000	0.0600	0.1620		
E16 Corner (normal)	2.7000	0.0900	0.2430		
E15 Flat roof with parapet	12.3800	0.5600	6.9328		
P4 Party wall - Roof (insulation at ceiling level)	0.7700	0.1200	0.0924		
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	31.9800	0.0000	0.0000		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				10.4019	(36)
Point Thermal bridges			(36a) =	0.0000	
Total fabric heat loss			(33) + (36) + (36a) =	38.1134	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3691	16.1966	16.0242	15.1620	14.9895	14.1273	14.1273	13.9548	14.4722	14.9895	15.3344	15.6793	(38)
Heat transfer coeff	54.4825	54.3100	54.1376	53.2753	53.1029	52.2406	52.2406	52.0682	52.5855	53.1029	53.4478	53.7927	(39)
Average = Sum(39)m / 12 =												53.2322	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7976	0.7951	0.7925	0.7799	0.7774	0.7648	0.7648	0.7622	0.7698	0.7774	0.7824	0.7875	(40)
HLP (average)												0.7793	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2044	(42)
Hot water usage for mixer showers	84.1229	82.8587	81.0165	77.4918	74.8906	71.9899	70.3411	72.1693	74.1734	77.2880	80.8884	83.8006	(42a)
Hot water usage for baths	26.4327	26.0402	25.4874	24.4681	23.7049	22.8586	22.4014	22.9504	23.5481	24.4536	25.4939	26.3434	(42b)
Hot water usage for other uses	37.2053	35.8524	34.4995	33.1466	31.7936	30.4407	30.4407	31.7936	33.1466	34.4995	35.8524	37.2053	(42c)
Average daily hot water use (litres/day)												135.8888	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	147.7609	144.7513	141.0033	135.1064	130.3891	125.2891	123.1832	126.9133	130.8681	136.2411	142.2347	147.3493	(44)
Energy conte	234.0172	206.1239	216.7169	184.9539	175.5288	154.0576	148.9794	157.1452	161.3734	184.8779	202.6394	230.7134	(45)
Energy content (annual)										Total = Sum(45)m =		2257.1270	
Distribution loss (46)m = 0.15 x (45)m	35.1026	30.9186	32.5075	27.7431	26.3293	23.1086	22.3469	23.5718	24.2060	27.7317	30.3959	34.6070	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	254.9980	225.0743	237.6977	205.2579	196.5096	174.3616	169.9602	178.1260	181.6774	205.8587	222.9434	251.6942	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	254.9980	225.0743	237.6977	205.2579	196.5096	174.3616	169.9602	178.1260	181.6774	205.8587	222.9434	251.6942	(64)
										Total per year (kWh/year) = Sum(64)m =		2504.1590	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	94.5954	83.6965	88.8430	77.7404	75.1480	67.4674	66.3203	69.0354	69.8999	78.2565	83.6208	93.4968	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	132.2644	132.2644	132.2644	132.2644	132.2644	132.2644	132.2644	132.2644	132.2644	132.2644	132.2644	132.2644	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.2532	19.7651	16.0740	12.1691	9.0965	7.6797	8.2982	10.7863	14.4773	18.3823	21.4548	22.8717	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	288.5388	291.5329	283.9878	267.9252	247.6490	228.5922	215.8611	212.8670	220.4121	236.4747	256.7509	275.8077	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.4308	50.4308	50.4308	50.4308	50.4308	50.4308	50.4308	50.4308	50.4308	50.4308	50.4308	50.4308	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-88.1762	-88.1762	-88.1762	-88.1762	-88.1762	-88.1762	-88.1762	-88.1762	-88.1762	-88.1762	-88.1762	-88.1762	(71)
Water heating gains (Table 5)	127.1443	124.5484	119.4126	107.9728	101.0053	93.7047	89.1402	92.7895	97.0831	105.1835	116.1400	125.6678	(72)
Total internal gains	532.4552	530.3653	513.9934	482.5860	452.2698	424.4955	407.8184	410.9617	426.4915	454.5594	488.8647	518.8661	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.1800	36.7938	0.6300	0.8270	0.7700	95.3847	(79)
Northwest	10.7700	11.2829	0.6300	0.8270	0.7700	43.8750	(81)

Solar gains	139.2597	251.7843	383.2122	539.7021	663.7341	684.9844	649.5572	553.0412	436.7771	288.7125	169.4550	117.4600	(83)
Total gains	671.7150	782.1497	897.2056	1022.2880	1116.0039	1109.4799	1057.3756	964.0029	863.2685	743.2719	658.3197	636.3261	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.7674	60.9604	61.1546	62.1443	62.3461	63.3752	63.3752	63.5851	62.9595	62.3461	61.9438	61.5467	
alpha	5.0512	5.0640	5.0770	5.1430	5.1564	5.2250	5.2250	5.2390	5.1973	5.1564	5.1296	5.1031	
util living area	0.9328	0.8779	0.7751	0.6075	0.4388	0.3009	0.2173	0.2483	0.4176	0.6938	0.8830	0.9440	(86)
MIT	20.3622	20.5771	20.7980	20.9466	20.9906	20.9990	20.9999	20.9997	20.9947	20.9173	20.6346	20.3160	(87)
Th 2	20.2554	20.2576	20.2598	20.2708	20.2730	20.2840	20.2840	20.2862	20.2796	20.2730	20.2686	20.2642	(88)
util rest of house	0.9218	0.8607	0.7493	0.5755	0.4055	0.2674	0.1820	0.2099	0.3750	0.6557	0.8635	0.9346	(89)
MIT 2	19.5328	19.7926	20.0497	20.2202	20.2653	20.2833	20.2839	20.2861	20.2759	20.1966	19.8759	19.4837	(90)
Living area fraction										fLA = Living area / (4) =		0.3592	(91)
MIT	19.8308	20.0744	20.3185	20.4811	20.5258	20.5404	20.5411	20.5424	20.5341	20.4555	20.1485	19.7827	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8308	20.0744	20.3185	20.4811	20.5258	20.5404	20.5411	20.5424	20.5341	20.4555	20.1485	19.7827	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9147	0.8561	0.7514	0.5849	0.4172	0.2795	0.1947	0.2237	0.3901	0.6655	0.8600	0.9275	(94)
Useful gains	614.3923	669.6164	674.2002	597.9063	465.5622	310.0443	205.8542	215.6233	336.7552	494.6753	566.1579	590.1859	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	846.1535	824.1220	748.1011	616.9886	468.6777	310.3317	205.8863	215.6890	338.3416	523.3534	697.4121	838.2359	(97)
Space heating kWh	172.4303	103.8277	54.9823	13.7392	2.3179	0.0000	0.0000	0.0000	0.0000	21.3365	94.5030	184.5492	(98a)
Space heating requirement - total per year (kWh/year)												647.6862	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	172.4303	103.8277	54.9823	13.7392	2.3179	0.0000	0.0000	0.0000	0.0000	21.3365	94.5030	184.5492	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												647.6862	
Space heating per m2											(98c) / (4) =	9.4816	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 100.0000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	172.4303	103.8277	54.9823	13.7392	2.3179	0.0000	0.0000	0.0000	0.0000	21.3365	94.5030	184.5492	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	172.4303	103.8277	54.9823	13.7392	2.3179	0.0000	0.0000	0.0000	0.0000	21.3365	94.5030	184.5492	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	254.9980	225.0743	237.6977	205.2579	196.5096	174.3616	169.9602	178.1260	181.6774	205.8587	222.9434	251.6942	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	254.9980	225.0743	237.6977	205.2579	196.5096	174.3616	169.9602	178.1260	181.6774	205.8587	222.9434	251.6942	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.8911	10.7404	11.8911	11.5075	11.8911	11.5075	11.8911	11.8911	11.5075	11.8911	11.5075	11.8911	(231)
Lighting	19.4781	15.6260	14.0695	10.3079	7.9621	6.5051	7.2633	9.4412	12.2631	16.0899	18.1735	20.0194	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.4369	-26.1239	-42.2071	-52.6954	-61.6202	-59.2315	-58.2876	-52.6118	-42.9773	-31.5830	-18.9103	-13.8520	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.9589	-7.1264	-16.3881	-28.0633	-39.6254	-40.7989	-40.2223	-32.5623	-22.2400	-11.4950	-4.2794	-2.2502	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year
Space heating fuel - main system 1 647.6862 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 100.0000
Water heating fuel used 2504.1590 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)
mechanical ventilation fans (SFP = 0.7000) 140.0082 (230a)
Total electricity for the above, kWh/year 140.0082 (231)
Electricity for lighting (calculated in Appendix L) 157.1992 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	-724.5474	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2724.5052	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	647.6862	16.4900	106.8034	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2504.1590	16.4900	412.9358	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	140.0082	16.4900	23.0873	(249)
Energy for lighting	157.1992	16.4900	25.9222	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-476.5371	16.4900	-78.5810	
PV Unit electricity exported	-248.0104	5.5900	-13.8638	
Total			-92.4447	(252)
Total energy cost			476.3040	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.5133	(257)
SAP value		75.4698	
SAP rating (Section 12)		75	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	647.6862	0.1585	102.6548	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2504.1590	0.1413	353.8266	(264)
Space and water heating			456.4814	(265)
Pumps, fans and electric keep-hot	140.0082	0.1387	19.4209	(267)
Energy for lighting	157.1992	0.1443	22.6887	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-476.5371	0.1324	-63.1081	
PV Unit electricity exported	-248.0104	0.1228	-30.4599	
Total			-93.5680	(269)
Total CO2, kg/year			405.0229	(272)
CO2 emissions per m2			5.9300	(273)
EI value			95.2102	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		68.3100 (1b)	x	2.4000 (2b)	=	163.9440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.3100						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	163.9440	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)

Infiltration rate												0.1500	(18)
Number of sides sheltered												2	(19)
Shelter factor								(20) = 1 - [0.075 x (19)] =				0.8500	(20)
Infiltration rate adjusted to include shelter factor								(21) = (18) x (20) =				0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery		
If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			17.9500	1.2357	22.1816			(27)
External Wall 1	44.2100	17.9500	26.2600	0.1400	3.6764	14.0000	367.6400	(29a)
External Roof 1	16.8500		16.8500	0.1100	1.8535	9.0000	151.6500	(30)
Total net area of external elements Aum(A, m2)			61.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.7115			(33)
Party Wall 1			14.8500	0.0000	0.0000	20.0000	297.0000	(32)
Wall to corridor			29.3600	0.0000	0.0000	20.0000	587.2000	(32)
Party Floor 1			68.3100			80.0000	5464.8000	(32d)
Party Ceiling 1			52.0200			80.0000	4161.6000	(32b)
Internal Wall 1			98.7600			9.0000	888.8400	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 11918.7300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	174.4800	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	7.7300	0.0500	0.3865
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	20.3600	0.0700	1.4252
E18 Party wall between dwellings	2.7000	0.0600	0.1620
E16 Corner (normal)	2.7000	0.0900	0.2430
E15 Flat roof with parapet	12.3800	0.5600	6.9328
P4 Party wall - Roof (insulation at ceiling level)	0.7700	0.1200	0.0924
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	31.9800	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.4019	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	38.1134	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.5415	16.5415	16.1966	15.1620	14.9895	14.2997	13.9548	13.9548	14.6446	15.5068	15.8517	15.6793	(38)
Heat transfer coeff	54.6549	54.6549	54.3100	53.2753	53.1029	52.4131	52.0682	52.0682	52.7580	53.6202	53.9651	53.7927	(39)
Average = Sum(39)m / 12 =												53.3903	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8001	0.8001	0.7951	0.7799	0.7774	0.7673	0.7622	0.7622	0.7723	0.7850	0.7900	0.7875	(40)
HLP (average)												0.7816	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2044	(42)

Hot water usage for mixer showers

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	84.1229	82.8587	81.0165	77.4918	74.8906	71.9899	70.3411	72.1693	74.1734	77.2880	80.8884	83.8006	(42a)

Hot water usage for baths

	26.4327	26.0402	25.4874	24.4681	23.7049	22.8586	22.4014	22.9504	23.5481	24.4536	25.4939	26.3434	(42b)

Hot water usage for other uses

	37.2053	35.8524	34.4995	33.1466	31.7936	30.4407	30.4407	31.7936	33.1466	34.4995	35.8524	37.2053	(42c)
Average daily hot water use (litres/day)												135.8888	(43)

Daily hot water use

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	147.7609	144.7513	141.0033	135.1064	130.3891	125.2891	123.1832	126.9133	130.8681	136.2411	142.2347	147.3493	(44)
Energy conte	234.0172	206.1239	216.7169	184.9539	175.5288	154.0576	148.9794	157.1452	161.3734	184.8779	202.6394	230.7134	(45)
Energy content (annual)										Total = Sum(45)m =		2257.1270	

Distribution loss (46)m = 0.15 x (45)m

	35.1026	30.9186	32.5075	27.7431	26.3293	23.1086	22.3469	23.5718	24.2060	27.7317	30.3959	34.6070	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

Total storage loss

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	254.9980	225.0743	237.6977	205.2579	196.5096	174.3616	169.9602	178.1260	181.6774	205.8587	222.9434	251.6942	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	254.9980	225.0743	237.6977	205.2579	196.5096	174.3616	169.9602	178.1260	181.6774	205.8587	222.9434	251.6942	(64)
									Total per year (kWh/year) = Sum(64)m =			2504.1590	(64)

Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

	94.5954	83.6965	88.8430	77.7404	75.1480	67.4674	66.3203	69.0354	69.8999	78.2565	83.6208	93.4968	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	132.2644	132.2644	132.2644	132.2644	132.2644	132.2644	132.2644	132.2644	132.2644	132.2644	132.2644	132.2644	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	22.2532	19.7651	16.0740	12.1691	9.0965	7.6797	8.2982	10.7863	14.4773	18.3823	21.4548	22.8717	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	288.5388	291.5329	283.9878	267.9252	247.6490	228.5922	215.8611	212.8670	220.4121	236.4747	256.7509	275.8077	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	50.4308	50.4308	50.4308	50.4308	50.4308	50.4308	50.4308	50.4308	50.4308	50.4308	50.4308	50.4308	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-88.1762	-88.1762	-88.1762	-88.1762	-88.1762	-88.1762	-88.1762	-88.1762	-88.1762	-88.1762	-88.1762	-88.1762	(71)

Water heating gains (Table 5)

	127.1443	124.5484	119.4126	107.9728	101.0053	93.7047	89.1402	92.7895	97.0831	105.1835	116.1400	125.6678	(72)

Total internal gains

	532.4552	530.3653	513.9934	482.5860	452.2698	424.4955	407.8184	410.9617	426.4915	454.5594	488.8647	518.8661	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.1800	33.4622	0.6300	0.8270	0.7700	86.7478	(79)
Northwest	10.7700	10.0309	0.6300	0.8270	0.7700	39.0064	(81)

Solar gains	125.7542	242.1565	384.2414	568.9470	693.6617	696.5737	668.3854	552.4600	433.7973	275.7222	157.1631	108.5367	(83)
Total gains	658.2095	772.5218	898.2349	1051.5330	1145.9314	1121.0692	1076.2038	963.4218	860.2887	730.2817	646.0278	627.4028	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.5757	60.5757	60.9604	62.1443	62.3461	63.1667	63.5851	63.5851	62.7537	61.7446	61.3500	61.5467	
alpha	5.0384	5.0384	5.0640	5.1430	5.1564	5.2111	5.2390	5.2390	5.1836	5.1163	5.0900	5.1031	
util living area	0.9425	0.8956	0.8039	0.6342	0.4717	0.3635	0.2948	0.3344	0.4957	0.7498	0.9025	0.9521	(86)
MIT	20.2930	20.5030	20.7426	20.9299	20.9856	20.9969	20.9991	20.9984	20.9860	20.8683	20.5622	20.2477	(87)
Th 2	20.2532	20.2532	20.2576	20.2708	20.2730	20.2818	20.2862	20.2862	20.2774	20.2664	20.2620	20.2642	(88)
util rest of house	0.9330	0.8805	0.7809	0.6043	0.4399	0.3304	0.2604	0.2961	0.4542	0.7156	0.8857	0.9440	(89)
MIT 2	19.4458	19.6998	19.9841	20.2023	20.2605	20.2795	20.2857	20.2852	20.2664	20.1389	19.7841	19.3988	(90)

Living area fraction fLA = Living area / (4) = 0.3592 (91)

MIT	19.7502	19.9883	20.2566	20.4637	20.5210	20.5372	20.5420	20.5414	20.5249	20.4009	20.0636	19.7038	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7502	19.9883	20.2566	20.4637	20.5210	20.5372	20.5420	20.5414	20.5249	20.4009	20.0636	19.7038	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9257	0.8747	0.7809	0.6124	0.4508	0.3422	0.2727	0.3098	0.4685	0.7221	0.8807	0.9369	(94)
Useful gains	609.2791	675.7102	701.4032	643.9169	516.5766	383.6079	293.5299	298.4957	403.0433	527.3687	568.9725	587.7988	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	866.2895	857.4436	795.9982	669.3340	521.5209	384.5666	293.7673	298.9444	407.5494	573.7870	726.5667	860.8859	(97)
Space heating kWh	191.2157	122.1249	70.3787	18.3003	3.6785	0.0000	0.0000	0.0000	0.0000	34.5353	113.4678	203.1768	(98a)
Space heating requirement - total per year (kWh/year)												756.8779	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	191.2157	122.1249	70.3787	18.3003	3.6785	0.0000	0.0000	0.0000	0.0000	34.5353	113.4678	203.1768	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												756.8779	
Space heating per m2											(98c) / (4) =	11.0800	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	191.2157	122.1249	70.3787	18.3003	3.6785	0.0000	0.0000	0.0000	0.0000	34.5353	113.4678	203.1768	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	191.2157	122.1249	70.3787	18.3003	3.6785	0.0000	0.0000	0.0000	0.0000	34.5353	113.4678	203.1768	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating												
Water heating requirement												
	254.9980	225.0743	237.6977	205.2579	196.5096	174.3616	169.9602	178.1260	181.6774	205.8587	222.9434	251.6942 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	254.9980	225.0743	237.6977	205.2579	196.5096	174.3616	169.9602	178.1260	181.6774	205.8587	222.9434	251.6942 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	11.8911	10.7404	11.8911	11.5075	11.8911	11.5075	11.8911	11.8911	11.5075	11.8911	11.5075	11.8911 (231)
Lighting	19.4781	15.6260	14.0695	10.3079	7.9621	6.5051	7.2633	9.4412	12.2631	16.0899	18.1735	20.0194 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-14.8968	-25.2057	-42.3905	-55.0511	-63.8417	-60.0908	-59.6348	-52.6278	-42.6942	-30.3857	-17.6197	-12.8086 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.4869	-6.5793	-16.1847	-30.1253	-42.2254	-41.9306	-42.0087	-32.5806	-21.9780	-10.5463	-3.7341	-1.9550 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	756.8779 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2504.1590 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	140.0082 (230a)
Total electricity for the above, kWh/year	140.0082 (231)
Electricity for lighting (calculated in Appendix L)	157.1992 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-729.5825 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2828.6619 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	756.8779	25.1600	190.4305	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2504.1590	25.1600	630.0464	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	140.0082	25.1600	35.2261	(249)
Energy for lighting	157.1992	25.1600	39.5513	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-477.2475	25.1600	-120.0755	
PV Unit electricity exported	-252.3350	5.8100	-14.6607	
Total			-134.7361	(252)
Total energy cost			760.5181	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	756.8779	0.1579	119.5268	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2504.1590	0.1413	353.8266	(264)
Space and water heating			473.3534	(265)
Pumps, fans and electric keep-hot	140.0082	0.1387	19.4209	(267)
Energy for lighting	157.1992	0.1443	22.6887	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-477.2475	0.1321	-63.0605	
PV Unit electricity exported	-252.3350	0.1223	-30.8547	
Total			-93.9151	(269)
Total CO2, kg/year			421.5478	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	756.8779	1.5846	1199.3151	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2504.1590	1.5225	3812.5309	(278)
Space and water heating			5011.8460	(279)
Pumps, fans and electric keep-hot	140.0082	1.5128	211.8044	(281)
Energy for lighting	157.1992	1.5338	241.1175	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-477.2475	1.4882	-710.2461	
PV Unit electricity exported	-252.3350	0.4487	-113.2302	
Total			-823.4763	(283)
Total Primary energy kWh/year			4641.2915	(286)

SAP 10 EPC IMPROVEMENTS

Unit 352 L06_Copy

Current energy efficiency rating: C 75
Current environmental impact rating: A 95

N Solar water heating	Not applicable
U Solar photovoltaic panels	Not applicable
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 75
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£895	£895	£0
Space heating	£226	£226	£0
Water heating	£630	£630	£0
Lighting	£40	£40	£0
Generated (PV)	-£135	-£135	£0
Total cost of fuels	£760	£760	£0
Total cost of uses	£761	£761	£0
Delivered energy	41 kWh/m²	41 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	68 kWh/m²	68 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	68.3100	(1b)	x 2.4000	(2b) =	163.9440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.3100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	163.9440	(5)

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2. Ventilation rate
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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			17.9500	1.2357	22.1816			(27)
External Wall 1	44.2100	17.9500	26.2600	0.1400	3.6764	14.0000	367.6400	(29a)
External Roof 1	16.8500		16.8500	0.1100	1.8535	9.0000	151.6500	(30)
Total net area of external elements Aum(A, m2)			61.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.7115			(33)
Party Wall 1			14.8500	0.0000	0.0000	20.0000	297.0000	(32)
Wall to corridor			29.3600	0.0000	0.0000	20.0000	587.2000	(32)
Party Floor 1			68.3100			80.0000	5464.8000	(32d)
Party Ceiling 1			52.0200			80.0000	4161.6000	(32b)
Internal Wall 1			98.7600			9.0000	888.8400	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 11918.7300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 174.4800 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	7.7300	0.0500	0.3865
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	20.3600	0.0700	1.4252
E18 Party wall between dwellings	2.7000	0.0600	0.1620
E16 Corner (normal)	2.7000	0.0900	0.2430
E15 Flat roof with parapet	12.3800	0.5600	6.9328
P4 Party wall - Roof (insulation at ceiling level)	0.7700	0.1200	0.0924
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	31.9800	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.4019 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 38.1134 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3691	16.1966	16.0242	15.1620	14.9895	14.1273	14.1273	13.9548	14.4722	14.9895	15.3344	15.6793	(38)
Heat transfer coeff	54.4825	54.3100	54.1376	53.2753	53.1029	52.2406	52.2406	52.0682	52.5855	53.1029	53.4478	53.7927	(39)
Average = Sum(39)m / 12 =												53.2322	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7976	0.7951	0.7925	0.7799	0.7774	0.7648	0.7648	0.7622	0.7698	0.7774	0.7824	0.7875	(40)
HLP (average)												0.7793	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2044 (42)
Hot water usage for mixer showers

84.1229	82.8587	81.0165	77.4918	74.8906	71.9899	70.3411	72.1693	74.1734	77.2880	80.8884	83.8006	(42a)

Hot water usage for baths

26.4327	26.0402	25.4874	24.4681	23.7049	22.8586	22.4014	22.9504	23.5481	24.4536	25.4939	26.3434	(42b)

Hot water usage for other uses

37.2053	35.8524	34.4995	33.1466	31.7936	30.4407	30.4407	31.7936	33.1466	34.4995	35.8524	37.2053	(42c)

Average daily hot water use (litres/day) 135.8888 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	147.7609	144.7513	141.0033	135.1064	130.3891	125.2891	123.1832	126.9133	130.8681	136.2411	142.2347	147.3493	(44)
Energy conte	234.0172	206.1239	216.7169	184.9539	175.5288	154.0576	148.9794	157.1452	161.3734	184.8779	202.6394	230.7134	(45)
Energy content (annual)										Total = Sum(45)m =		2257.1270	
Distribution loss (46)m = 0.15 x (45)m	35.1026	30.9186	32.5075	27.7431	26.3293	23.1086	22.3469	23.5718	24.2060	27.7317	30.3959	34.6070	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	254.9980	225.0743	237.6977	205.2579	196.5096	174.3616	169.9602	178.1260	181.6774	205.8587	222.9434	251.6942	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	254.9980	225.0743	237.6977	205.2579	196.5096	174.3616	169.9602	178.1260	181.6774	205.8587	222.9434	251.6942	(64)
										Total per year (kWh/year) = Sum(64)m =		2504.1590	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	94.5954	83.6965	88.8430	77.7404	75.1480	67.4674	66.3203	69.0354	69.8999	78.2565	83.6208	93.4968	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	132.2644	132.2644	132.2644	132.2644	132.2644	132.2644	132.2644	132.2644	132.2644	132.2644	132.2644	132.2644	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.2532	19.7651	16.0740	12.1691	9.0965	7.6797	8.2982	10.7863	14.4773	18.3823	21.4548	22.8717	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	288.5388	291.5329	283.9878	267.9252	247.6490	228.5922	215.8611	212.8670	220.4121	236.4747	256.7509	275.8077	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	50.4308	50.4308	50.4308	50.4308	50.4308	50.4308	50.4308	50.4308	50.4308	50.4308	50.4308	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)												
	-88.1762	-88.1762	-88.1762	-88.1762	-88.1762	-88.1762	-88.1762	-88.1762	-88.1762	-88.1762	-88.1762	(71)
Water heating gains (Table 5)												
	127.1443	124.5484	119.4126	107.9728	101.0053	93.7047	89.1402	92.7895	97.0831	105.1835	116.1400	125.6678 (72)
Total internal gains												
	532.4552	530.3653	513.9934	482.5860	452.2698	424.4955	407.8184	410.9617	426.4915	454.5594	488.8647	518.8661 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.1800	36.7938	0.6300	0.8270	0.7700	95.3847	(79)
Northwest	10.7700	11.2829	0.6300	0.8270	0.7700	43.8750	(81)

Solar gains	139.2597	251.7843	383.2122	539.7021	663.7341	684.9844	649.5572	553.0412	436.7771	288.7125	169.4550	117.4600 (83)
Total gains	671.7150	782.1497	897.2056	1022.2880	1116.0039	1109.4799	1057.3756	964.0029	863.2685	743.2719	658.3197	636.3261 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.7674	60.9604	61.1546	62.1443	62.3461	63.3752	63.3752	63.5851	62.9595	62.3461	61.9438	61.5467	
alpha	5.0512	5.0640	5.0770	5.1430	5.1564	5.2250	5.2250	5.2390	5.1973	5.1564	5.1296	5.1031	
util living area													
	0.9328	0.8779	0.7751	0.6075	0.4388	0.3009	0.2173	0.2483	0.4176	0.6938	0.8830	0.9440	(86)
MIT	20.3622	20.5771	20.7980	20.9466	20.9906	20.9990	20.9999	20.9997	20.9947	20.9173	20.6346	20.3160	(87)
Th 2	20.2554	20.2576	20.2598	20.2708	20.2730	20.2840	20.2840	20.2862	20.2796	20.2730	20.2686	20.2642	(88)
util rest of house													
	0.9218	0.8607	0.7493	0.5755	0.4055	0.2674	0.1820	0.2099	0.3750	0.6557	0.8635	0.9346	(89)
MIT 2	19.5328	19.7926	20.0497	20.2202	20.2653	20.2833	20.2839	20.2861	20.2759	20.1966	19.8759	19.4837	(90)
Living area fraction										fLA = Living area / (4) =		0.3592	(91)
MIT	19.8308	20.0744	20.3185	20.4811	20.5258	20.5404	20.5411	20.5424	20.5341	20.4555	20.1485	19.7827	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8308	20.0744	20.3185	20.4811	20.5258	20.5404	20.5411	20.5424	20.5341	20.4555	20.1485	19.7827	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9147	0.8561	0.7514	0.5849	0.4172	0.2795	0.1947	0.2237	0.3901	0.6655	0.8600	0.9275	(94)
Useful gains	614.3923	669.6164	674.2002	597.9063	465.5622	310.0443	205.8542	215.6233	336.7552	494.6753	566.1579	590.1859	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	846.1535	824.1220	748.1011	616.9886	468.6777	310.3317	205.8863	215.6890	338.3416	523.3534	697.4121	838.2359	(97)
Space heating kWh													
	172.4303	103.8277	54.9823	13.7392	2.3179	0.0000	0.0000	0.0000	0.0000	21.3365	94.5030	184.5492	(98a)
Space heating requirement - total per year (kWh/year)												647.6862	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	172.4303	103.8277	54.9823	13.7392	2.3179	0.0000	0.0000	0.0000	0.0000	21.3365	94.5030	184.5492	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												647.6862	
Space heating per m2											(98c) / (4) =	9.4816	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 100.0000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	172.4303	103.8277	54.9823	13.7392	2.3179	0.0000	0.0000	0.0000	0.0000	21.3365	94.5030	184.5492	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	172.4303	103.8277	54.9823	13.7392	2.3179	0.0000	0.0000	0.0000	0.0000	21.3365	94.5030	184.5492	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	254.9980	225.0743	237.6977	205.2579	196.5096	174.3616	169.9602	178.1260	181.6774	205.8587	222.9434	251.6942	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	254.9980	225.0743	237.6977	205.2579	196.5096	174.3616	169.9602	178.1260	181.6774	205.8587	222.9434	251.6942	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.8911	10.7404	11.8911	11.5075	11.8911	11.5075	11.8911	11.8911	11.5075	11.8911	11.5075	11.8911	(231)
Lighting	19.4781	15.6260	14.0695	10.3079	7.9621	6.5051	7.2633	9.4412	12.2631	16.0899	18.1735	20.0194	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.4369	-26.1239	-42.2071	-52.6954	-61.6202	-59.2315	-58.2876	-52.6118	-42.9773	-31.5830	-18.9103	-13.8520	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													

(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.9589	-7.1264	-16.3881	-28.0633	-39.6254	-40.7989	-40.2223	-32.5623	-22.2400	-11.4950	-4.2794	-2.2502	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	647.6862	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2504.1590	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	140.0082	(230a)
Total electricity for the above, kWh/year	140.0082	(231)
Electricity for lighting (calculated in Appendix L)	157.1992	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-724.5474	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2724.5052	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	647.6862	16.4900	106.8034	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2504.1590	16.4900	412.9358	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	140.0082	16.4900	23.0873	(249)
Energy for lighting	157.1992	16.4900	25.9222	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-476.5371	16.4900	-78.5810	
PV Unit electricity exported	-248.0104	5.5900	-13.8638	
Total			-92.4447	(252)
Total energy cost			476.3040	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.5133	(257)
SAP value	75.4698	
SAP rating (Section 12)	75	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	647.6862	0.1585	102.6548	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2504.1590	0.1413	353.8266	(264)
Space and water heating			456.4814	(265)
Pumps, fans and electric keep-hot	140.0082	0.1387	19.4209	(267)
Energy for lighting	157.1992	0.1443	22.6887	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-476.5371	0.1324	-63.1081	
PV Unit electricity exported	-248.0104	0.1228	-30.4599	
Total			-93.5680	(269)
Total CO2, kg/year			405.0229	(272)
CO2 emissions per m2			5.9300	(273)
EI value			95.2102	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area	Storey height	Volume	

	(m2)		(m)		(m3)	
Ground floor	68.3100 (1b)	x	2.4000 (2b)	=	163.9440 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.3100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	163.9440	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			17.9500	1.2357	22.1816			(27)
External Wall 1	44.2100	17.9500	26.2600	0.1400	3.6764	14.0000	367.6400	(29a)
External Roof 1	16.8500		16.8500	0.1100	1.8535	9.0000	151.6500	(30)
Total net area of external elements Aum(A, m2)			61.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.7115			(33)
Party Wall 1			14.8500	0.0000	0.0000	20.0000	297.0000	(32)
Wall to corridor			29.3600	0.0000	0.0000	20.0000	587.2000	(32)
Party Floor 1			68.3100			80.0000	5464.8000	(32d)
Party Ceiling 1			52.0200			80.0000	4161.6000	(32b)
Internal Wall 1			98.7600			9.0000	888.8400	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 11918.7300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	174.4800	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	7.7300	0.0500	0.3865
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	20.3600	0.0700	1.4252
E18 Party wall between dwellings	2.7000	0.0600	0.1620
E16 Corner (normal)	2.7000	0.0900	0.2430
E15 Flat roof with parapet	12.3800	0.5600	6.9328
P4 Party wall - Roof (insulation at ceiling level)	0.7700	0.1200	0.0924
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	31.9800	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.4019	(36)
Point Thermal bridges	(36a) = 0.0000	
Total fabric heat loss	(33) + (36) + (36a) = 38.1134	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.5415	16.5415	16.1966	15.1620	14.9895	14.2997	13.9548	13.9548	14.6446	15.5068	15.8517	15.6793	(38)
Heat transfer coeff	54.6549	54.6549	54.3100	53.2753	53.1029	52.4131	52.0682	52.0682	52.7580	53.6202	53.9651	53.7927	(39)
Average = Sum(39)m / 12 =												53.3903	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8001	0.8001	0.7951	0.7799	0.7774	0.7673	0.7622	0.7622	0.7723	0.7850	0.7900	0.7875	(40)
HLP (average)												0.7816	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2044	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	84.1229	82.8587	81.0165	77.4918	74.8906	71.9899	70.3411	72.1693	74.1734	77.2880	80.8884	83.8006	(42a)
Hot water usage for baths	26.4327	26.0402	25.4874	24.4681	23.7049	22.8586	22.4014	22.9504	23.5481	24.4536	25.4939	26.3434	(42b)
Hot water usage for other uses	37.2053	35.8524	34.4995	33.1466	31.7936	30.4407	30.4407	31.7936	33.1466	34.4995	35.8524	37.2053	(42c)
Average daily hot water use (litres/day)												135.8888	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	147.7609	144.7513	141.0033	135.1064	130.3891	125.2891	123.1832	126.9133	130.8681	136.2411	142.2347	147.3493	(44)

Energy conte	234.0172	206.1239	216.7169	184.9539	175.5288	154.0576	148.9794	157.1452	161.3734	184.8779	202.6394	230.7134	(45)
Energy content (annual)										Total = Sum(45)m =		2257.1270	
Distribution loss (46)m = 0.15 x (45)m													
	35.1026	30.9186	32.5075	27.7431	26.3293	23.1086	22.3469	23.5718	24.2060	27.7317	30.3959	34.6070	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	254.9980	225.0743	237.6977	205.2579	196.5096	174.3616	169.9602	178.1260	181.6774	205.8587	222.9434	251.6942	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	254.9980	225.0743	237.6977	205.2579	196.5096	174.3616	169.9602	178.1260	181.6774	205.8587	222.9434	251.6942	(64)
										Total per year (kWh/year) = Sum(64)m =		2504.1590	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						0.0000	(64a)
Heat gains from water heating, kWh/month													
	94.5954	83.6965	88.8430	77.7404	75.1480	67.4674	66.3203	69.0354	69.8999	78.2565	83.6208	93.4968	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	132.2644	132.2644	132.2644	132.2644	132.2644	132.2644	132.2644	132.2644	132.2644	132.2644	132.2644	132.2644	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.2532	19.7651	16.0740	12.1691	9.0965	7.6797	8.2982	10.7863	14.4773	18.3823	21.4548	22.8717	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	288.5388	291.5329	283.9878	267.9252	247.6490	228.5922	215.8611	212.8670	220.4121	236.4747	256.7509	275.8077	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.4308	50.4308	50.4308	50.4308	50.4308	50.4308	50.4308	50.4308	50.4308	50.4308	50.4308	50.4308	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-88.1762	-88.1762	-88.1762	-88.1762	-88.1762	-88.1762	-88.1762	-88.1762	-88.1762	-88.1762	-88.1762	-88.1762	(71)
Water heating gains (Table 5)													
	127.1443	124.5484	119.4126	107.9728	101.0053	93.7047	89.1402	92.7895	97.0831	105.1835	116.1400	125.6678	(72)
Total internal gains													
	532.4552	530.3653	513.9934	482.5860	452.2698	424.4955	407.8184	410.9617	426.4915	454.5594	488.8647	518.8661	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.1800	33.4622	0.6300	0.8270	0.7700	86.7478	(79)
Northwest	10.7700	10.0309	0.6300	0.8270	0.7700	39.0064	(81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	125.7542	242.1565	384.2414	568.9470	693.6617	696.5737	668.3854	552.4600	433.7973	275.7222	157.1631	108.5367	(83)
Total gains	658.2095	772.5218	898.2349	1051.5330	1145.9314	1121.0692	1076.2038	963.4218	860.2887	730.2817	646.0278	627.4028	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.5757	60.5757	60.9604	62.1443	62.3461	63.1667	63.5851	63.5851	62.7537	61.7446	61.3500	61.5467	
alpha	5.0384	5.0384	5.0640	5.1430	5.1564	5.2111	5.2390	5.2390	5.1836	5.1163	5.0900	5.1031	
util living area													
	0.9425	0.8956	0.8039	0.6342	0.4717	0.3635	0.2948	0.3344	0.4957	0.7498	0.9025	0.9521	(86)
MIT	20.2930	20.5030	20.7426	20.9299	20.9856	20.9969	20.9991	20.9984	20.9860	20.8683	20.5622	20.2477	(87)
Th 2	20.2532	20.2532	20.2576	20.2708	20.2730	20.2818	20.2862	20.2862	20.2774	20.2664	20.2620	20.2642	(88)
util rest of house													
	0.9330	0.8805	0.7809	0.6043	0.4399	0.3304	0.2604	0.2961	0.4542	0.7156	0.8857	0.9440	(89)
MIT 2	19.4458	19.6998	19.9841	20.2023	20.2605	20.2795	20.2857	20.2852	20.2664	20.1389	19.7841	19.3988	(90)
Living area fraction										fLA = Living area / (4) =		0.3592	(91)
MIT	19.7502	19.9883	20.2566	20.4637	20.5210	20.5372	20.5420	20.5414	20.5249	20.4009	20.0636	19.7038	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7502	19.9883	20.2566	20.4637	20.5210	20.5372	20.5420	20.5414	20.5249	20.4009	20.0636	19.7038	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9257	0.8747	0.7809	0.6124	0.4508	0.3422	0.2727	0.3098	0.4685	0.7221	0.8807	0.9369	(94)
Useful gains	609.2791	675.7102	701.4032	643.9169	516.5766	383.6079	293.5299	298.4957	403.0433	527.3687	568.9725	587.7988	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	866.2895	857.4436	795.9982	669.3340	521.5209	384.5666	293.7673	298.9444	407.5494	573.7870	726.5667	860.8859	(97)
Space heating kWh													
	191.2157	122.1249	70.3787	18.3003	3.6785	0.0000	0.0000	0.0000	0.0000	34.5353	113.4678	203.1768	(98a)
Space heating requirement - total per year (kWh/year)												756.8779	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	191.2157	122.1249	70.3787	18.3003	3.6785	0.0000	0.0000	0.0000	0.0000	34.5353	113.4678	203.1768	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 756.8779
Space heating per m2 (98c) / (4) = 11.0800 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 100.0000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	191.2157	122.1249	70.3787	18.3003	3.6785	0.0000	0.0000	0.0000	0.0000	34.5353	113.4678	203.1768	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	191.2157	122.1249	70.3787	18.3003	3.6785	0.0000	0.0000	0.0000	0.0000	34.5353	113.4678	203.1768	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	254.9980	225.0743	237.6977	205.2579	196.5096	174.3616	169.9602	178.1260	181.6774	205.8587	222.9434	251.6942	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	254.9980	225.0743	237.6977	205.2579	196.5096	174.3616	169.9602	178.1260	181.6774	205.8587	222.9434	251.6942	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.8911	10.7404	11.8911	11.5075	11.8911	11.5075	11.8911	11.8911	11.5075	11.8911	11.5075	11.8911	(231)
Lighting	19.4781	15.6260	14.0695	10.3079	7.9621	6.5051	7.2633	9.4412	12.2631	16.0899	18.1735	20.0194	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.8968	-25.2057	-42.3905	-55.0511	-63.8417	-60.0908	-59.6348	-52.6278	-42.6942	-30.3857	-17.6197	-12.8086	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4869	-6.5793	-16.1847	-30.1253	-42.2254	-41.9306	-42.0087	-32.5806	-21.9780	-10.5463	-3.7341	-1.9550	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year
Space heating fuel - main system 1 756.8779 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 100.0000
Water heating fuel used 2504.1590 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)
mechanical ventilation fans (SFP = 0.7000) 140.0082 (230a)
Total electricity for the above, kWh/year 140.0082 (231)
Electricity for lighting (calculated in Appendix L) 157.1992 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation -729.5825 (233)
Wind generation 0.0000 (234)
Hydro-electric generation (Appendix N) 0.0000 (235a)
Electricity generated - Micro CHP (Appendix N) 0.0000 (235)
Appendix Q - special features
Energy saved or generated -0.0000 (236)
Energy used 0.0000 (237)
Total delivered energy for all uses 2828.6619 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	756.8779	25.1600	190.4305	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2504.1590	25.1600	630.0464	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	140.0082	25.1600	35.2261	(249)
Energy for lighting	157.1992	25.1600	39.5513	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-477.2475	25.1600	-120.0755	
PV Unit electricity exported	-252.3350	5.8100	-14.6607	
Total			-134.7361	(252)
Total energy cost			760.5181	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	756.8779	0.1579	119.5268	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2504.1590	0.1413	353.8266	(264)
Space and water heating			473.3534	(265)

Pumps, fans and electric keep-hot	140.0082	0.1387	19.4209	(267)
Energy for lighting	157.1992	0.1443	22.6887	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-477.2475	0.1321	-63.0605	
PV Unit electricity exported	-252.3350	0.1223	-30.8547	
Total			-93.9151	(269)
Total CO2, kg/year			421.5478	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	756.8779	1.5846	1199.3151	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2504.1590	1.5225	3812.5309	(278)
Space and water heating			5011.8460	(279)
Pumps, fans and electric keep-hot	140.0082	1.5128	211.8044	(281)
Energy for lighting	157.1992	1.5338	241.1175	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-477.2475	1.4882	-710.2461	
PV Unit electricity exported	-252.3350	0.4487	-113.2302	
Total			-823.4763	(283)
Total Primary energy kWh/year			4641.2915	(286)

Predicted Energy Assessment

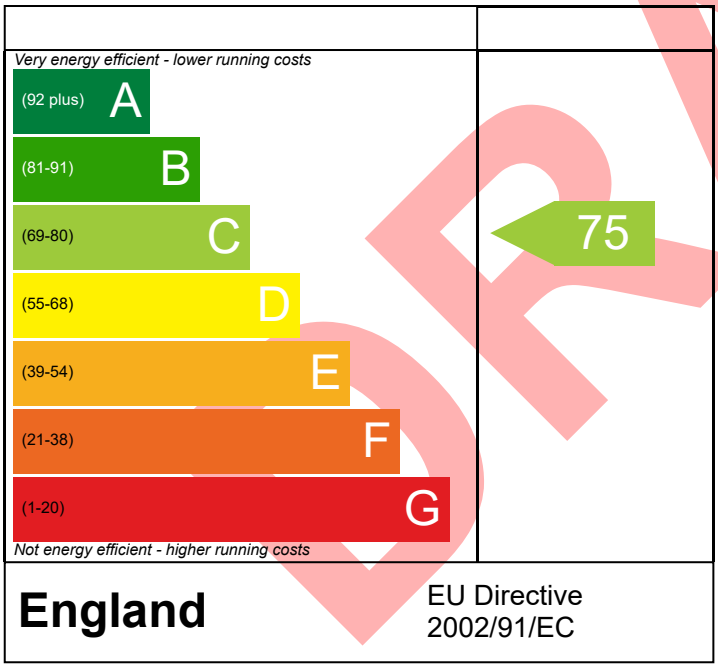
elmhurst energy

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	68.31 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

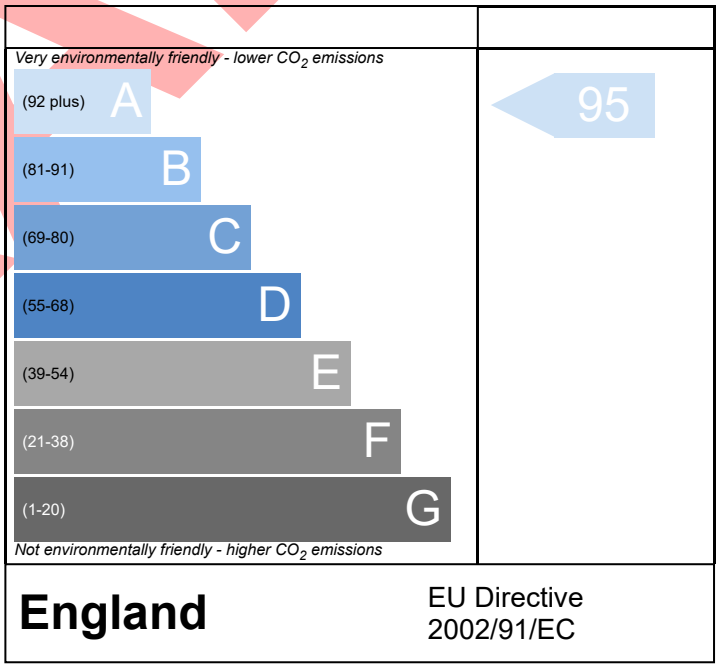
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:56

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	77 m^2
Site Reference	Unit 362 L07_Copy	Plot Reference	Unit 362 L07_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*14.05 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	6.99 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*75.69 kWh_{PE}/m^2*	
Dwelling primary energy	76.13 kWh_{PE}/m^2	FAIL
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*37.4 kWh/m^2*	
Dwelling fabric energy efficiency	35.4 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	32.53	0.14 **(!)**
Party wall: Party Wall (1)	39.47	0 **(!)**
Party wall: Party Wall (2)	22.81	0 **(!)**
Exposed roof: Roof (1)	77.38	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	2.11	South West	0.83	1.3
NE, Opening Type 1	10.56	North East	0.83	1.3
N, Opening Type 1	2.11	North	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	
External wall	E15: Flat roof with parapet	Calculated by person with suitable expertise	0.56	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.12	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	1.01 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 362 L07_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 362 L07_Copy	**Prop Type Ref**	Unit 362 L07
Property			

SAP Rating	71 C	**DER**	6.99	**TER**	14.05
Environmental	94 A	**% DER < TER**			50.25
CO_2 Emissions (t/year)	0.55	**DFEE**	35.39	**TFEE**	37.36
Compliance Check	See BREL	**% DFEE < TFEE**			5.30
% DPER < TPER	-0.59	**DPER**	76.13	**TPER**	75.69

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	77.3800 (1b)	x	2.4000 (2b)	=	185.7120	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.3800					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	185.7120	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.7800	1.2357	18.2643			(27)
External Wall 1	47.3100	14.7800	32.5300	0.1400	4.5542	14.0000	455.4200	(29a)
External Roof 1	77.3800		77.3800	0.1100	8.5118	9.0000	696.4200	(30)
Total net area of external elements Aum(A, m2)			124.6900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.3303			(33)
Party Wall 1			39.4700	0.0000	0.0000	20.0000	789.4000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			77.3800			80.0000	6190.4000	(32d)
Internal Wall 1			160.7500			9.0000	1446.7500	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) =	10034.5900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	129.6794 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	6.3700	0.0500	0.3185

E4 Jamb	32.4800	0.0500	1.6240	
E7 Party floor between dwellings (in blocks of flats)	18.5300	0.0700	1.2971	
E18 Party wall between dwellings	2.7000	0.0600	0.1620	
E16 Corner (normal)	5.4000	0.0900	0.4860	
E15 Flat roof with parapet	18.5300	0.5600	10.3768	
P4 Party wall - Roof (insulation at ceiling level)	23.0700	0.1200	2.7684	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.0700	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 17.0328 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 48.3631 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	18.5425	18.3472	18.1518	17.1751	16.9798	16.0030	16.0030	15.8077	16.3937	16.9798	17.3705	17.7611	(38)
Heat transfer coeff	66.9056	66.7102	66.5149	65.5382	65.3428	64.3661	64.3661	64.1707	64.7568	65.3428	65.7335	66.1242	(39)

Average = Sum(39)m / 12 = 65.4893

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8646	0.8621	0.8596	0.8470	0.8444	0.8318	0.8318	0.8293	0.8369	0.8444	0.8495	0.8545	(40)
HLP (average)												0.8463	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.4113 (42)

Hot water usage for mixer showers

88.8920	87.5561	85.6095	81.8850	79.1364	76.0712	74.3289	76.2608	78.3785	81.6696	85.4742	88.5514	(42a)

Hot water usage for baths

27.9243	27.5096	26.9256	25.8488	25.0425	24.1484	23.6655	24.2454	24.8769	25.8335	26.9325	27.8299	(42b)

Hot water usage for other uses

39.3238	37.8938	36.4639	35.0339	33.6040	32.1740	32.1740	33.6040	35.0339	36.4639	37.8938	39.3238	(42c)

Average daily hot water use (litres/day) 143.5946 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	156.1401	152.9596	148.9990	142.7677	137.7828	132.3936	130.1684	134.1102	138.2893	143.9670	150.3005	155.7051	(44)
Energy conte	247.2878	217.8124	229.0059	195.4418	185.4822	162.7934	157.4274	166.0564	170.5245	195.3619	214.1306	243.7966	(45)

Energy content (annual) Total = Sum(45)m = 2385.1210

Distribution loss (46)m = 0.15 x (45)m

37.0932	32.6719	34.3509	29.3163	27.8223	24.4190	23.6141	24.9085	25.5787	29.3043	32.1196	36.5695	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

268.2686	236.7628	249.9867	215.7458	206.4630	183.0974	178.4082	187.0372	190.8285	216.3427	234.4346	264.7774	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

268.2686	236.7628	249.9867	215.7458	206.4630	183.0974	178.4082	187.0372	190.8285	216.3427	234.4346	264.7774	(64)

Total per year (kWh/year) = Sum(64)m = 2632.1530 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

99.0078	87.5829	92.9291	81.2276	78.4575	70.3720	69.1293	71.9984	72.9426	81.7425	87.4416	97.8470	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.6761	144.6761	144.6761	144.6761	144.6761	144.6761	144.6761	144.6761	144.6761	144.6761	144.6761	144.6761	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.6153	21.8631	17.7803	13.4608	10.0621	8.4949	9.1790	11.9312	16.0140	20.3335	23.7322	25.2994	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	319.2205	322.5331	314.1856	296.4150	273.9827	252.8995	238.8147	235.5021	243.8496	261.6202	284.0525	305.1357	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.8789	51.8789	51.8789	51.8789	51.8789	51.8789	51.8789	51.8789	51.8789	51.8789	51.8789	51.8789	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-96.4507	-96.4507	-96.4507	-96.4507	-96.4507	-96.4507	-96.4507	-96.4507	-96.4507	-96.4507	-96.4507	-96.4507	(71)
Water heating gains (Table 5)	133.0750	130.3318	124.9047	112.8161	105.4536	97.7389	92.9157	96.7720	101.3092	109.8689	121.4467	131.5148	(72)
Total internal gains	577.0151	574.8322	556.9749	522.7962	489.6026	459.2375	441.0136	444.3096	461.2770	491.9269	529.3357	562.0542	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1100	10.6334	0.6300	0.8270	0.7700	8.1009	(74)
Northeast	10.5600	11.2829	0.6300	0.8270	0.7700	43.0195	(75)
Southwest	2.1100	36.7938	0.6300	0.8270	0.7700	28.0309	(79)

Solar gains	79.1513	150.7957	249.4046	382.3028	495.8712	522.2538	491.0216	401.5760	294.6105	178.2134	97.6977	65.8738	(83)
Total gains	656.1664	725.6278	806.3795	905.0990	985.4739	981.4913	932.0352	845.8856	755.8875	670.1403	627.0334	627.9280	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.6615	41.7835	41.9062	42.5307	42.6579	43.3052	43.3052	43.4370	43.0439	42.6579	42.4043	42.1538	
alpha	3.7774	3.7856	3.7937	3.8354	3.8439	3.8870	3.8870	3.8958	3.8696	3.8439	3.8270	3.8103	
util living area	0.9400	0.9132	0.8557	0.7378	0.5759	0.4113	0.3018	0.3452	0.5569	0.7991	0.9113	0.9471	(86)
MIT	19.7783	19.9950	20.3291	20.6926	20.9013	20.9795	20.9952	20.9921	20.9362	20.6460	20.1605	19.7360	(87)
Th 2	20.1977	20.1998	20.2020	20.2128	20.2150	20.2258	20.2258	20.2280	20.2215	20.2150	20.2106	20.2063	(88)
util rest of house	0.9314	0.9013	0.8369	0.7078	0.5355	0.3641	0.2495	0.2887	0.5030	0.7672	0.8972	0.9395	(89)
MIT 2	18.7804	19.0504	19.4599	19.8953	20.1245	20.2107	20.2233	20.2235	20.1703	19.8552	19.2688	18.7342	(90)
Living area fraction										fLA = Living area / (4) =		0.3341	(91)
MIT	19.1138	19.3660	19.7502	20.1616	20.3840	20.4676	20.4812	20.4803	20.4261	20.1194	19.5667	19.0688	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1138	19.3660	19.7502	20.1616	20.3840	20.4676	20.4812	20.4803	20.4261	20.1194	19.5667	19.0688	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9173	0.8868	0.8250	0.7057	0.5444	0.3790	0.2669	0.3073	0.5175	0.7630	0.8838	0.9260	(94)
Useful gains	601.9052	643.4617	665.2878	638.7453	536.4568	371.9434	248.7192	259.9538	391.1913	511.3172	554.1417	581.4491	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	991.1232	965.0282	881.3384	738.0659	567.4344	377.6715	249.8161	261.8352	409.6610	622.0220	819.4793	983.1909	(97)
Space heating kWh	289.5782	216.0927	160.7417	71.5108	23.0473	0.0000	0.0000	0.0000	0.0000	82.3644	191.0431	298.8959	(98a)
Space heating requirement - total per year (kWh/year)												1333.2742	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	289.5782	216.0927	160.7417	71.5108	23.0473	0.0000	0.0000	0.0000	0.0000	82.3644	191.0431	298.8959	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1333.2742	
Space heating per m2											(98c) / (4) =	17.2302	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 100.0000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	289.5782	216.0927	160.7417	71.5108	23.0473	0.0000	0.0000	0.0000	0.0000	82.3644	191.0431	298.8959	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	289.5782	216.0927	160.7417	71.5108	23.0473	0.0000	0.0000	0.0000	0.0000	82.3644	191.0431	298.8959	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	268.2686	236.7628	249.9867	215.7458	206.4630	183.0974	178.4082	187.0372	190.8285	216.3427	234.4346	264.7774	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	268.2686	236.7628	249.9867	215.7458	206.4630	183.0974	178.4082	187.0372	190.8285	216.3427	234.4346	264.7774	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	14.2782	12.8964	14.2782	13.8176	14.2782	13.8176	14.2782	14.2782	13.8176	14.2782	13.8176	14.2782	(231)
Lighting	21.5456	17.2847	15.5630	11.4021	8.8073	7.1956	8.0343	10.4433	13.5648	17.7978	20.1026	22.1444	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-18.9728	-30.3306	-49.2187	-61.1269	-70.4210	-66.8591	-65.7919	-59.4596	-48.6724	-36.5570	-21.8787	-15.9753	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.2883	-7.8317	-18.0326	-31.5621	-45.7814	-47.9486	-47.2707	-38.2971	-26.1793	-12.8847	-4.7369	-2.5056	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 1333.2742 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 100.0000

Water heating fuel used 2632.1530 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)

mechanical ventilation fans (SFP = 0.7420) 168.1139 (230a)

Total electricity for the above, kWh/year 168.1139 (231)

Electricity for lighting (calculated in Appendix L) 173.8855 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	-831.5829	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3475.8437	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1333.2742	16.4900	219.8569	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2632.1530	16.4900	434.0420	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	168.1139	16.4900	27.7220	(249)
Energy for lighting	173.8855	16.4900	28.6737	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-545.2640	16.4900	-89.9140	
PV Unit electricity exported	-286.3188	5.5900	-16.0052	
Total			-105.9193	(252)
Total energy cost			604.3754	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.7779	(257)
SAP value		71.1808	
SAP rating (Section 12)		71	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1333.2742	0.1563	208.4070	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2632.1530	0.1413	371.9478	(264)
Space and water heating			580.3547	(265)
Pumps, fans and electric keep-hot	168.1139	0.1387	23.3195	(267)
Energy for lighting	173.8855	0.1443	25.0971	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-545.2640	0.1326	-72.3156	
PV Unit electricity exported	-286.3188	0.1221	-34.9681	
Total			-107.2836	(269)
Total CO2, kg/year			521.4876	(272)
CO2 emissions per m2			6.7400	(273)
EI value			94.2900	
EI rating			94	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		77.3800 (1b)	x	2.4000 (2b)	=	185.7120	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.3800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	185.7120	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)

Infiltration rate												0.1500	(18)
Number of sides sheltered												2	(19)
Shelter factor								(20) = 1 - [0.075 x (19)] =				0.8500	(20)
Infiltration rate adjusted to include shelter factor								(21) = (18) x (20) =				0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery		
If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.7800	1.2357	18.2643			(27)
External Wall 1	47.3100	14.7800	32.5300	0.1400	4.5542	14.0000	455.4200	(29a)
External Roof 1	77.3800		77.3800	0.1100	8.5118	9.0000	696.4200	(30)
Total net area of external elements Aum(A, m2)			124.6900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.3303			(33)
Party Wall 1			39.4700	0.0000	0.0000	20.0000	789.4000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			77.3800			80.0000	6190.4000	(32d)
Internal Wall 1			160.7500			9.0000	1446.7500	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 10034.5900	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	129.6794	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	6.3700	0.0500	0.3185
E4 Jamb	32.4800	0.0500	1.6240
E7 Party floor between dwellings (in blocks of flats)	18.5300	0.0700	1.2971
E18 Party wall between dwellings	2.7000	0.0600	0.1620
E16 Corner (normal)	5.4000	0.0900	0.4860
E15 Flat roof with parapet	18.5300	0.5600	10.3768
P4 Party wall - Roof (insulation at ceiling level)	23.0700	0.1200	2.7684
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.0700	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	17.0328	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	48.3631	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	18.7379	18.7379	18.3472	17.1751	16.9798	16.1984	15.8077	15.8077	16.5891	17.5658	17.9565	17.7611	(38)
Heat transfer coeff	67.1009	67.1009	66.7102	65.5382	65.3428	64.5614	64.1707	64.1707	64.9521	65.9289	66.3196	66.1242	(39)
Average = Sum(39)m / 12 =												65.6684	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8672	0.8672	0.8621	0.8470	0.8444	0.8343	0.8293	0.8293	0.8394	0.8520	0.8571	0.8545	(40)
HLP (average)												0.8486	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4113	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	88.8920	87.5561	85.6095	81.8850	79.1364	76.0712	74.3289	76.2608	78.3785	81.6696	85.4742	88.5514	(42a)
Hot water usage for baths	27.9243	27.5096	26.9256	25.8488	25.0425	24.1484	23.6655	24.2454	24.8769	25.8335	26.9325	27.8299	(42b)
Hot water usage for other uses	39.3238	37.8938	36.4639	35.0339	33.6040	32.1740	32.1740	33.6040	35.0339	36.4639	37.8938	39.3238	(42c)
Average daily hot water use (litres/day)												143.5946	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	156.1401	152.9596	148.9990	142.7677	137.7828	132.3936	130.1684	134.1102	138.2893	143.9670	150.3005	155.7051	(44)
Energy conte	247.2878	217.8124	229.0059	195.4418	185.4822	162.7934	157.4274	166.0564	170.5245	195.3619	214.1306	243.7966	(45)
Energy content (annual)										Total = Sum(45)m =		2385.1210	
Distribution loss (46)m = 0.15 x (45)m	37.0932	32.6719	34.3509	29.3163	27.8223	24.4190	23.6141	24.9085	25.5787	29.3043	32.1196	36.5695	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	268.2686	236.7628	249.9867	215.7458	206.4630	183.0974	178.4082	187.0372	190.8285	216.3427	234.4346	264.7774	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	268.2686	236.7628	249.9867	215.7458	206.4630	183.0974	178.4082	187.0372	190.8285	216.3427	234.4346	264.7774	(64)
										Total per year (kWh/year) = Sum(64)m =		2632.1530	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	99.0078	87.5829	92.9291	81.2276	78.4575	70.3720	69.1293	71.9984	72.9426	81.7425	87.4416	97.8470	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.6761	144.6761	144.6761	144.6761	144.6761	144.6761	144.6761	144.6761	144.6761	144.6761	144.6761	144.6761	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	24.6153	21.8631	17.7803	13.4608	10.0621	8.4949	9.1790	11.9312	16.0140	20.3335	23.7322	25.2994	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	319.2205	322.5331	314.1856	296.4150	273.9827	252.8995	238.8147	235.5021	243.8496	261.6202	284.0525	305.1357	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.8789	51.8789	51.8789	51.8789	51.8789	51.8789	51.8789	51.8789	51.8789	51.8789	51.8789	51.8789	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-96.4507	-96.4507	-96.4507	-96.4507	-96.4507	-96.4507	-96.4507	-96.4507	-96.4507	-96.4507	-96.4507	-96.4507	(71)
Water heating gains (Table 5)													
	133.0750	130.3318	124.9047	112.8161	105.4536	97.7389	92.9157	96.7720	101.3092	109.8689	121.4467	131.5148	(72)
Total internal gains													
	577.0151	574.8322	556.9749	522.7962	489.6026	459.2375	441.0136	444.3096	461.2770	491.9269	529.3357	562.0542	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1100	9.5462	0.6300	0.8270	0.7700	7.2726	(74)
Northeast	10.5600	10.0309	0.6300	0.8270	0.7700	38.2458	(75)
Southwest	2.1100	33.4622	0.6300	0.8270	0.7700	25.4927	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	71.0112	143.9017	247.9620	400.0441	515.2613	528.5070	502.6041	398.4605	290.1958	168.7970	89.9849	60.5011	(83)
Total gains	648.0264	718.7338	804.9368	922.8403	1004.8639	987.7445	943.6177	842.7702	751.4729	660.7239	619.3205	622.5553	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.5402	41.5402	41.7835	42.5307	42.6579	43.1742	43.4370	43.4370	42.9145	42.2787	42.0296	42.1538	
alpha	3.7693	3.7693	3.7856	3.8354	3.8439	3.8783	3.8958	3.8958	3.8610	3.8186	3.8020	3.8103	
util living area													
	0.9459	0.9236	0.8752	0.7636	0.6145	0.4908	0.4068	0.4584	0.6415	0.8372	0.9226	0.9526	(86)
MIT	19.6966	19.8859	20.2113	20.6223	20.8634	20.9536	20.9814	20.9714	20.8756	20.5298	20.0613	19.6509	(87)
Th 2	20.1955	20.1955	20.1998	20.2128	20.2150	20.2237	20.2280	20.2280	20.2193	20.2085	20.2041	20.2063	(88)
util rest of house													
	0.9382	0.9131	0.8590	0.7369	0.5774	0.4467	0.3579	0.4054	0.5945	0.8108	0.9103	0.9458	(89)
MIT 2	18.6762	18.9114	19.3143	19.8131	20.0841	20.1849	20.2147	20.2070	20.1083	19.7145	19.1414	18.6268	(90)
Living area fraction										fLA = Living area / (4) =		0.3341	(91)
MIT	19.0171	19.2370	19.6140	20.0835	20.3445	20.4417	20.4708	20.4624	20.3646	19.9868	19.4487	18.9689	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0171	19.2370	19.6140	20.0835	20.3445	20.4417	20.4708	20.4624	20.3646	19.9868	19.4487	18.9689	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9244	0.8984	0.8458	0.7323	0.5837	0.4593	0.3734	0.4217	0.6036	0.8027	0.8964	0.9327	(94)
Useful gains	599.0162	645.7347	680.7785	675.7842	586.5466	453.6358	352.3788	355.4338	453.5772	530.3533	555.1704	580.6419	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	1014.3699	1002.2840	934.8761	798.4818	630.1974	467.5360	357.4837	363.3595	491.3401	678.2002	852.1219	1009.6440	(97)
Space heating kWh													
	309.0231	239.6011	189.0486	88.3423	32.4761	0.0000	0.0000	0.0000	0.0000	109.9981	213.8051	319.1776	(98a)
Space heating requirement - total per year (kWh/year)												1501.4720	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	309.0231	239.6011	189.0486	88.3423	32.4761	0.0000	0.0000	0.0000	0.0000	109.9981	213.8051	319.1776	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1501.4720	
Space heating per m2											(98c) / (4) =	19.4039	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	309.0231	239.6011	189.0486	88.3423	32.4761	0.0000	0.0000	0.0000	0.0000	109.9981	213.8051	319.1776	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	309.0231	239.6011	189.0486	88.3423	32.4761	0.0000	0.0000	0.0000	0.0000	109.9981	213.8051	319.1776	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating
Water heating requirement

	268.2686	236.7628	249.9867	215.7458	206.4630	183.0974	178.4082	187.0372	190.8285	216.3427	234.4346	264.7774 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	268.2686	236.7628	249.9867	215.7458	206.4630	183.0974	178.4082	187.0372	190.8285	216.3427	234.4346	264.7774 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	14.2782	12.8964	14.2782	13.8176	14.2782	13.8176	14.2782	14.2782	13.8176	14.2782	13.8176	14.2782 (231)
Lighting	21.5456	17.2847	15.5630	11.4021	8.8073	7.1956	8.0343	10.4433	13.5648	17.7978	20.1026	22.1444 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-17.1831	-29.2533	-49.5171	-64.1580	-73.2664	-67.8177	-67.2944	-59.4774	-48.3546	-35.2662	-20.3739	-14.7650 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.7687	-7.2271	-17.7112	-33.6013	-48.4697	-49.2751	-49.3647	-38.3186	-25.8715	-11.7126	-4.1345	-2.1796 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year

Space heating fuel - main system 1	1501.4720 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2632.1530 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	168.1139 (230a)
Total electricity for the above, kWh/year	168.1139 (231)
Electricity for lighting (calculated in Appendix L)	173.8855 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-837.3617 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3638.2628 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1501.4720	25.1600	377.7704	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2632.1530	25.1600	662.2497	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	168.1139	25.1600	42.2975	(249)
Energy for lighting	173.8855	25.1600	43.7496	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-546.7270	25.1600	-137.5565	
PV Unit electricity exported	-290.6347	5.8100	-16.8859	
Total			-154.4424	(252)
Total energy cost			971.6247	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1501.4720	0.1557	233.8214	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2632.1530	0.1413	371.9478	(264)
Space and water heating			605.7692	(265)
Pumps, fans and electric keep-hot	168.1139	0.1387	23.3195	(267)
Energy for lighting	173.8855	0.1443	25.0971	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-546.7270	0.1323	-72.3511	
PV Unit electricity exported	-290.6347	0.1216	-35.3275	
Total			-107.6787	(269)
Total CO2, kg/year			546.5071	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1501.4720	1.5765	2367.1298	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2632.1530	1.5225	4007.5347	(278)
Space and water heating			6374.6646	(279)
Pumps, fans and electric keep-hot	168.1139	1.5128	254.3228	(281)
Energy for lighting	173.8855	1.5338	266.7114	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-546.7270	1.4890	-814.0631	
PV Unit electricity exported	-290.6347	0.4460	-129.6219	
Total			-943.6850	(283)
Total Primary energy kWh/year			5952.0138	(286)

SAP 10 EPC IMPROVEMENTS

Unit 362 L07_Copy

Current energy efficiency rating: C 71
Current environmental impact rating: A 94

N Solar water heating	Not applicable
U Solar photovoltaic panels	Not applicable
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 71
Potential environmental impact rating: A 94

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£1126	£1126	£0
Space heating	£420	£420	£0
Water heating	£662	£662	£0
Lighting	£44	£44	£0
Generated (PV)	-£154	-£154	£0
Total cost of fuels	£972	£972	£0
Total cost of uses	£972	£972	£0
Delivered energy	47 kWh/m²	47 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.5 tonnes	0.0 tonnes
CO2 emissions per m²	7 kg/m²	7 kg/m²	0 kg/m²
Primary energy	77 kWh/m²	77 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	77.3800	(1b)	x 2.4000	(2b) =	185.7120	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.3800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	185.7120	(5)

---
2. Ventilation rate
---

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.7800	1.2357	18.2643			(27)
External Wall 1	47.3100	14.7800	32.5300	0.1400	4.5542	14.0000	455.4200	(29a)
External Roof 1	77.3800		77.3800	0.1100	8.5118	9.0000	696.4200	(30)
Total net area of external elements Aum(A, m2)			124.6900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.3303			(33)
Party Wall 1			39.4700	0.0000	0.0000	20.0000	789.4000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			77.3800			80.0000	6190.4000	(32d)
Internal Wall 1			160.7500			9.0000	1446.7500	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 10034.5900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 129.6794 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	6.3700	0.0500	0.3185
E4 Jamb	32.4800	0.0500	1.6240
E7 Party floor between dwellings (in blocks of flats)	18.5300	0.0700	1.2971
E18 Party wall between dwellings	2.7000	0.0600	0.1620
E16 Corner (normal)	5.4000	0.0900	0.4860
E15 Flat roof with parapet	18.5300	0.5600	10.3768
P4 Party wall - Roof (insulation at ceiling level)	23.0700	0.1200	2.7684
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.0700	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 17.0328 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 48.3631 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	18.5425	18.3472	18.1518	17.1751	16.9798	16.0030	16.0030	15.8077	16.3937	16.9798	17.3705	17.7611	(38)
Heat transfer coeff	66.9056	66.7102	66.5149	65.5382	65.3428	64.3661	64.3661	64.1707	64.7568	65.3428	65.7335	66.1242	(39)

Average = Sum(39)m / 12 = 65.4893

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8646	0.8621	0.8596	0.8470	0.8444	0.8318	0.8318	0.8293	0.8369	0.8444	0.8495	0.8545	(40)
HLP (average)												0.8463	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.4113 (42)
Hot water usage for mixer showers

88.8920	87.5561	85.6095	81.8850	79.1364	76.0712	74.3289	76.2608	78.3785	81.6696	85.4742	88.5514	(42a)

Hot water usage for baths

27.9243	27.5096	26.9256	25.8488	25.0425	24.1484	23.6655	24.2454	24.8769	25.8335	26.9325	27.8299	(42b)

Hot water usage for other uses

39.3238	37.8938	36.4639	35.0339	33.6040	32.1740	32.1740	33.6040	35.0339	36.4639	37.8938	39.3238	(42c)

Average daily hot water use (litres/day) 143.5946 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	156.1401	152.9596	148.9990	142.7677	137.7828	132.3936	130.1684	134.1102	138.2893	143.9670	150.3005	155.7051	(44)
Energy conte	247.2878	217.8124	229.0059	195.4418	185.4822	162.7934	157.4274	166.0564	170.5245	195.3619	214.1306	243.7966	(45)
Energy content (annual)										Total = Sum(45)m =		2385.1210	
Distribution loss (46)m = 0.15 x (45)m	37.0932	32.6719	34.3509	29.3163	27.8223	24.4190	23.6141	24.9085	25.5787	29.3043	32.1196	36.5695	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

268.2686	236.7628	249.9867	215.7458	206.4630	183.0974	178.4082	187.0372	190.8285	216.3427	234.4346	264.7774	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

268.2686	236.7628	249.9867	215.7458	206.4630	183.0974	178.4082	187.0372	190.8285	216.3427	234.4346	264.7774	(64)

Total per year (kWh/year) = Sum(64)m = 2632.1530 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

99.0078	87.5829	92.9291	81.2276	78.4575	70.3720	69.1293	71.9984	72.9426	81.7425	87.4416	97.8470	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.6761	144.6761	144.6761	144.6761	144.6761	144.6761	144.6761	144.6761	144.6761	144.6761	144.6761	144.6761	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.6153	21.8631	17.7803	13.4608	10.0621	8.4949	9.1790	11.9312	16.0140	20.3335	23.7322	25.2994	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	319.2205	322.5331	314.1856	296.4150	273.9827	252.8995	238.8147	235.5021	243.8496	261.6202	284.0525	305.1357	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	51.8789	51.8789	51.8789	51.8789	51.8789	51.8789	51.8789	51.8789	51.8789	51.8789	51.8789	51.8789	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-96.4507	-96.4507	-96.4507	-96.4507	-96.4507	-96.4507	-96.4507	-96.4507	-96.4507	-96.4507	-96.4507	-96.4507	(71)
Water heating gains (Table 5)													
	133.0750	130.3318	124.9047	112.8161	105.4536	97.7389	92.9157	96.7720	101.3092	109.8689	121.4467	131.5148	(72)
Total internal gains													
	577.0151	574.8322	556.9749	522.7962	489.6026	459.2375	441.0136	444.3096	461.2770	491.9269	529.3357	562.0542	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1100	10.6334	0.6300	0.8270	0.7700	8.1009	(74)
Northeast	10.5600	11.2829	0.6300	0.8270	0.7700	43.0195	(75)
Southwest	2.1100	36.7938	0.6300	0.8270	0.7700	28.0309	(79)

Solar gains	79.1513	150.7957	249.4046	382.3028	495.8712	522.2538	491.0216	401.5760	294.6105	178.2134	97.6977	65.8738	(83)
Total gains	656.1664	725.6278	806.3795	905.0990	985.4739	981.4913	932.0352	845.8856	755.8875	670.1403	627.0334	627.9280	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.6615	41.7835	41.9062	42.5307	42.6579	43.3052	43.3052	43.4370	43.0439	42.6579	42.4043	42.1538	
alpha	3.7774	3.7856	3.7937	3.8354	3.8439	3.8870	3.8870	3.8958	3.8696	3.8439	3.8270	3.8103	
util living area													
	0.9400	0.9132	0.8557	0.7378	0.5759	0.4113	0.3018	0.3452	0.5569	0.7991	0.9113	0.9471	(86)
MIT	19.7783	19.9950	20.3291	20.6926	20.9013	20.9795	20.9952	20.9921	20.9362	20.6460	20.1605	19.7360	(87)
Th 2	20.1977	20.1998	20.2020	20.2128	20.2150	20.2258	20.2258	20.2280	20.2215	20.2150	20.2106	20.2063	(88)
util rest of house													
	0.9314	0.9013	0.8369	0.7078	0.5355	0.3641	0.2495	0.2887	0.5030	0.7672	0.8972	0.9395	(89)
MIT 2	18.7804	19.0504	19.4599	19.8953	20.1245	20.2107	20.2233	20.2235	20.1703	19.8552	19.2688	18.7342	(90)
Living area fraction										fLA = Living area / (4) =		0.3341	(91)
MIT	19.1138	19.3660	19.7502	20.1616	20.3840	20.4676	20.4812	20.4803	20.4261	20.1194	19.5667	19.0688	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1138	19.3660	19.7502	20.1616	20.3840	20.4676	20.4812	20.4803	20.4261	20.1194	19.5667	19.0688	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9173	0.8868	0.8250	0.7057	0.5444	0.3790	0.2669	0.3073	0.5175	0.7630	0.8838	0.9260	(94)
Useful gains	601.9052	643.4617	665.2878	638.7453	536.4568	371.9434	248.7192	259.9538	391.1913	511.3172	554.1417	581.4491	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	991.1232	965.0282	881.3384	738.0659	567.4344	377.6715	249.8161	261.8352	409.6610	622.0220	819.4793	983.1909	(97)
Space heating kWh													
	289.5782	216.0927	160.7417	71.5108	23.0473	0.0000	0.0000	0.0000	0.0000	82.3644	191.0431	298.8959	(98a)
Space heating requirement - total per year (kWh/year)												1333.2742	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	289.5782	216.0927	160.7417	71.5108	23.0473	0.0000	0.0000	0.0000	0.0000	82.3644	191.0431	298.8959	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1333.2742	
Space heating per m2											(98c) / (4) =	17.2302	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	289.5782	216.0927	160.7417	71.5108	23.0473	0.0000	0.0000	0.0000	0.0000	82.3644	191.0431	298.8959	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	289.5782	216.0927	160.7417	71.5108	23.0473	0.0000	0.0000	0.0000	0.0000	82.3644	191.0431	298.8959	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	268.2686	236.7628	249.9867	215.7458	206.4630	183.0974	178.4082	187.0372	190.8285	216.3427	234.4346	264.7774	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	268.2686	236.7628	249.9867	215.7458	206.4630	183.0974	178.4082	187.0372	190.8285	216.3427	234.4346	264.7774	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	14.2782	12.8964	14.2782	13.8176	14.2782	13.8176	14.2782	14.2782	13.8176	14.2782	13.8176	14.2782	(231)
Lighting	21.5456	17.2847	15.5630	11.4021	8.8073	7.1956	8.0343	10.4433	13.5648	17.7978	20.1026	22.1444	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-18.9728	-30.3306	-49.2187	-61.1269	-70.4210	-66.8591	-65.7919	-59.4596	-48.6724	-36.5570	-21.8787	-15.9753	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													

(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.2883	-7.8317	-18.0326	-31.5621	-45.7814	-47.9486	-47.2707	-38.2971	-26.1793	-12.8847	-4.7369	-2.5056	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1333.2742	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2632.1530	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	168.1139	(230a)
Total electricity for the above, kWh/year	168.1139	(231)
Electricity for lighting (calculated in Appendix L)	173.8855	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-831.5829	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3475.8437	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1333.2742	16.4900	219.8569	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2632.1530	16.4900	434.0420	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	168.1139	16.4900	27.7220	(249)
Energy for lighting	173.8855	16.4900	28.6737	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-545.2640	16.4900	-89.9140	
PV Unit electricity exported	-286.3188	5.5900	-16.0052	
Total			-105.9193	(252)
Total energy cost			604.3754	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.7779	(257)
SAP value	71.1808	
SAP rating (Section 12)	71	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1333.2742	0.1563	208.4070	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2632.1530	0.1413	371.9478	(264)
Space and water heating			580.3547	(265)
Pumps, fans and electric keep-hot	168.1139	0.1387	23.3195	(267)
Energy for lighting	173.8855	0.1443	25.0971	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-545.2640	0.1326	-72.3156	
PV Unit electricity exported	-286.3188	0.1221	-34.9681	
Total			-107.2836	(269)
Total CO2, kg/year			521.4876	(272)
CO2 emissions per m2			6.7400	(273)
EI value			94.2900	
EI rating			94	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area	Storey height	Volume	

	(m2)		(m)		(m3)	
Ground floor	77.3800 (1b)	x	2.4000 (2b)	=	185.7120	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.3800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	185.7120	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.7800	1.2357	18.2643			(27)
External Wall 1	47.3100	14.7800	32.5300	0.1400	4.5542	14.0000	455.4200	(29a)
External Roof 1	77.3800		77.3800	0.1100	8.5118	9.0000	696.4200	(30)
Total net area of external elements Aum(A, m2)			124.6900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.3303			(33)
Party Wall 1			39.4700	0.0000	0.0000	20.0000	789.4000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			77.3800			80.0000	6190.4000	(32d)
Internal Wall 1			160.7500			9.0000	1446.7500	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 10034.5900	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	129.6794	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	6.3700	0.0500	0.3185
E4 Jamb	32.4800	0.0500	1.6240
E7 Party floor between dwellings (in blocks of flats)	18.5300	0.0700	1.2971
E18 Party wall between dwellings	2.7000	0.0600	0.1620
E16 Corner (normal)	5.4000	0.0900	0.4860
E15 Flat roof with parapet	18.5300	0.5600	10.3768
P4 Party wall - Roof (insulation at ceiling level)	23.0700	0.1200	2.7684
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.0700	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	17.0328	(36)
Point Thermal bridges	(36a) = 0.0000	
Total fabric heat loss	(33) + (36) + (36a) = 48.3631	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	18.7379	18.7379	18.3472	17.1751	16.9798	16.1984	15.8077	15.8077	16.5891	17.5658	17.9565	17.7611	(38)
Heat transfer coeff	67.1009	67.1009	66.7102	65.5382	65.3428	64.5614	64.1707	64.1707	64.9521	65.9289	66.3196	66.1242	(39)
Average = Sum(39)m / 12 =												65.6684	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8672	0.8672	0.8621	0.8470	0.8444	0.8343	0.8293	0.8293	0.8394	0.8520	0.8571	0.8545	(40)
HLP (average)												0.8486	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4113	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
88.8920	87.5561	85.6095	81.8850	79.1364	76.0712	74.3289	76.2608	78.3785	81.6696	85.4742	88.5514	(42a)

Hot water usage for baths

27.9243	27.5096	26.9256	25.8488	25.0425	24.1484	23.6655	24.2454	24.8769	25.8335	26.9325	27.8299	(42b)

Hot water usage for other uses

39.3238	37.8938	36.4639	35.0339	33.6040	32.1740	32.1740	33.6040	35.0339	36.4639	37.8938	39.3238	(42c)
Average daily hot water use (litres/day)												143.5946	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	156.1401	152.9596	148.9990	142.7677	137.7828	132.3936	130.1684	134.1102	138.2893	143.9670	150.3005	155.7051	(44)
Energy conte	247.2878	217.8124	229.0059	195.4418	185.4822	162.7934	157.4274	166.0564	170.5245	195.3619	214.1306	243.7966	(45)

Energy content (annual)											Total = Sum(45)m =	2385.1210	
Distribution loss (46)m = 0.15 x (45)m													
	37.0932	32.6719	34.3509	29.3163	27.8223	24.4190	23.6141	24.9085	25.5787	29.3043	32.1196	36.5695	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	268.2686	236.7628	249.9867	215.7458	206.4630	183.0974	178.4082	187.0372	190.8285	216.3427	234.4346	264.7774	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	268.2686	236.7628	249.9867	215.7458	206.4630	183.0974	178.4082	187.0372	190.8285	216.3427	234.4346	264.7774	(64)
										Total per year (kWh/year) = Sum(64)m =		2632.1530	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	99.0078	87.5829	92.9291	81.2276	78.4575	70.3720	69.1293	71.9984	72.9426	81.7425	87.4416	97.8470	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.6761	144.6761	144.6761	144.6761	144.6761	144.6761	144.6761	144.6761	144.6761	144.6761	144.6761	144.6761	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	24.6153	21.8631	17.7803	13.4608	10.0621	8.4949	9.1790	11.9312	16.0140	20.3335	23.7322	25.2994	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	319.2205	322.5331	314.1856	296.4150	273.9827	252.8995	238.8147	235.5021	243.8496	261.6202	284.0525	305.1357	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.8789	51.8789	51.8789	51.8789	51.8789	51.8789	51.8789	51.8789	51.8789	51.8789	51.8789	51.8789	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-96.4507	-96.4507	-96.4507	-96.4507	-96.4507	-96.4507	-96.4507	-96.4507	-96.4507	-96.4507	-96.4507	-96.4507	(71)
Water heating gains (Table 5)													
	133.0750	130.3318	124.9047	112.8161	105.4536	97.7389	92.9157	96.7720	101.3092	109.8689	121.4467	131.5148	(72)
Total internal gains													
	577.0151	574.8322	556.9749	522.7962	489.6026	459.2375	441.0136	444.3096	461.2770	491.9269	529.3357	562.0542	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1100	9.5462	0.6300	0.8270	0.7700	7.2726	(74)
Northeast	10.5600	10.0309	0.6300	0.8270	0.7700	38.2458	(75)
Southwest	2.1100	33.4622	0.6300	0.8270	0.7700	25.4927	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	71.0112	143.9017	247.9620	400.0441	515.2613	528.5070	502.6041	398.4605	290.1958	168.7970	89.9849	60.5011	(83)
Total gains	648.0264	718.7338	804.9368	922.8403	1004.8639	987.7445	943.6177	842.7702	751.4729	660.7239	619.3205	622.5553	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.5402	41.5402	41.7835	42.5307	42.6579	43.1742	43.4370	43.4370	42.9145	42.2787	42.0296	42.1538	
alpha	3.7693	3.7693	3.7856	3.8354	3.8439	3.8783	3.8958	3.8958	3.8610	3.8186	3.8020	3.8103	
util living area													
	0.9459	0.9236	0.8752	0.7636	0.6145	0.4908	0.4068	0.4584	0.6415	0.8372	0.9226	0.9526	(86)
MIT	19.6966	19.8859	20.2113	20.6223	20.8634	20.9536	20.9814	20.9714	20.8756	20.5298	20.0613	19.6509	(87)
Th 2	20.1955	20.1955	20.1998	20.2128	20.2150	20.2237	20.2280	20.2280	20.2193	20.2085	20.2041	20.2063	(88)
util rest of house													
	0.9382	0.9131	0.8590	0.7369	0.5774	0.4467	0.3579	0.4054	0.5945	0.8108	0.9103	0.9458	(89)
MIT 2	18.6762	18.9114	19.3143	19.8131	20.0841	20.1849	20.2147	20.2070	20.1083	19.7145	19.1414	18.6268	(90)
Living area fraction										fLA = Living area / (4) =		0.3341	(91)
MIT	19.0171	19.2370	19.6140	20.0835	20.3445	20.4417	20.4708	20.4624	20.3646	19.9868	19.4487	18.9689	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0171	19.2370	19.6140	20.0835	20.3445	20.4417	20.4708	20.4624	20.3646	19.9868	19.4487	18.9689	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9244	0.8984	0.8458	0.7323	0.5837	0.4593	0.3734	0.4217	0.6036	0.8027	0.8964	0.9327	(94)
Useful gains	599.0162	645.7347	680.7785	675.7842	586.5466	453.6358	352.3788	355.4338	453.5772	530.3533	555.1704	580.6419	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	1014.3699	1002.2840	934.8761	798.4818	630.1974	467.5360	357.4837	363.3595	491.3401	678.2002	852.1219	1009.6440	(97)
Space heating kWh													
	309.0231	239.6011	189.0486	88.3423	32.4761	0.0000	0.0000	0.0000	0.0000	109.9981	213.8051	319.1776	(98a)
Space heating requirement - total per year (kWh/year)												1501.4720	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	309.0231	239.6011	189.0486	88.3423	32.4761	0.0000	0.0000	0.0000	0.0000	109.9981	213.8051	319.1776	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 1501.4720
Space heating per m2 (98c) / (4) = 19.4039 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 100.0000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	309.0231	239.6011	189.0486	88.3423	32.4761	0.0000	0.0000	0.0000	0.0000	109.9981	213.8051	319.1776	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000		(210)
Space heating fuel (main heating system)													
	309.0231	239.6011	189.0486	88.3423	32.4761	0.0000	0.0000	0.0000	0.0000	109.9981	213.8051	319.1776	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	268.2686	236.7628	249.9867	215.7458	206.4630	183.0974	178.4082	187.0372	190.8285	216.3427	234.4346	264.7774	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	268.2686	236.7628	249.9867	215.7458	206.4630	183.0974	178.4082	187.0372	190.8285	216.3427	234.4346	264.7774	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	14.2782	12.8964	14.2782	13.8176	14.2782	13.8176	14.2782	14.2782	13.8176	14.2782	13.8176	14.2782	(231)
Lighting	21.5456	17.2847	15.5630	11.4021	8.8073	7.1956	8.0343	10.4433	13.5648	17.7978	20.1026	22.1444	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-17.1831	-29.2533	-49.5171	-64.1580	-73.2664	-67.8177	-67.2944	-59.4774	-48.3546	-35.2662	-20.3739	-14.7650	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.7687	-7.2271	-17.7112	-33.6013	-48.4697	-49.2751	-49.3647	-38.3186	-25.8715	-11.7126	-4.1345	-2.1796	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year
Space heating fuel - main system 1 1501.4720 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 100.0000
Water heating fuel used 2632.1530 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)
mechanical ventilation fans (SFP = 0.7420) 168.1139 (230a)
Total electricity for the above, kWh/year 168.1139 (231)
Electricity for lighting (calculated in Appendix L) 173.8855 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation -837.3617 (233)
Wind generation 0.0000 (234)
Hydro-electric generation (Appendix N) 0.0000 (235a)
Electricity generated - Micro CHP (Appendix N) 0.0000 (235)
Appendix Q - special features
Energy saved or generated -0.0000 (236)
Energy used 0.0000 (237)
Total delivered energy for all uses 3638.2628 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1501.4720	25.1600	377.7704	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2632.1530	25.1600	662.2497	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	168.1139	25.1600	42.2975	(249)
Energy for lighting	173.8855	25.1600	43.7496	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-546.7270	25.1600	-137.5565	
PV Unit electricity exported	-290.6347	5.8100	-16.8859	
Total			-154.4424	(252)
Total energy cost			971.6247	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1501.4720	0.1557	233.8214	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2632.1530	0.1413	371.9478	(264)
Space and water heating			605.7692	(265)

Pumps, fans and electric keep-hot	168.1139	0.1387	23.3195	(267)
Energy for lighting	173.8855	0.1443	25.0971	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-546.7270	0.1323	-72.3511	
PV Unit electricity exported	-290.6347	0.1216	-35.3275	
Total			-107.6787	(269)
Total CO2, kg/year			546.5071	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1501.4720	1.5765	2367.1298	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2632.1530	1.5225	4007.5347	(278)
Space and water heating			6374.6646	(279)
Pumps, fans and electric keep-hot	168.1139	1.5128	254.3228	(281)
Energy for lighting	173.8855	1.5338	266.7114	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-546.7270	1.4890	-814.0631	
PV Unit electricity exported	-290.6347	0.4460	-129.6219	
Total			-943.6850	(283)
Total Primary energy kWh/year			5952.0138	(286)

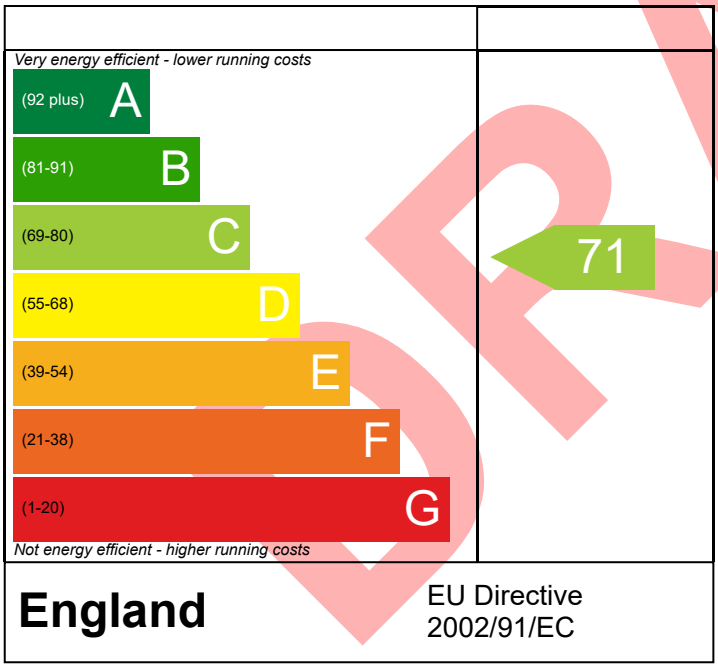
Predicted Energy Assessment

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	77.38 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

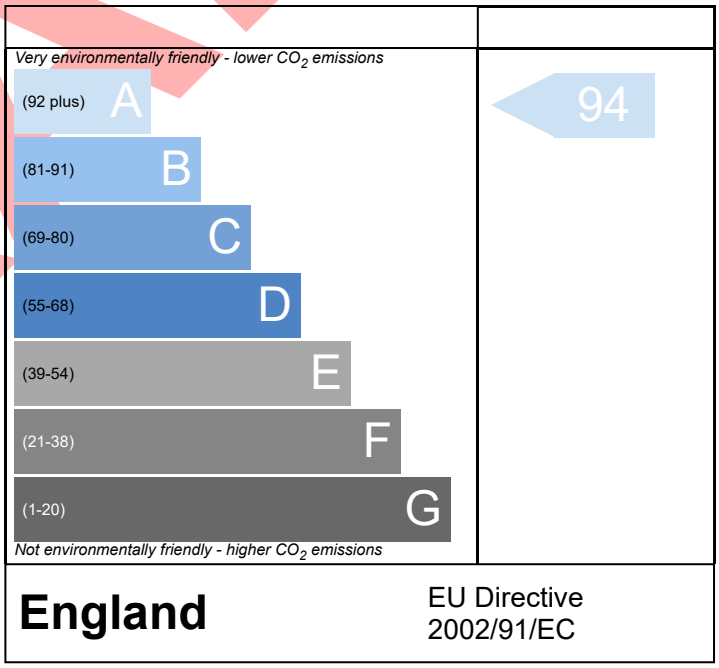
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:57

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	65 m^2
Site Reference	Unit 363 L07_Copy	Plot Reference	Unit 363 L07_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*15.34 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	7.79 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*82.81 kWh$_{PE}$/m^2*	
Dwelling primary energy	84.51 kWh$_{PE}$/m^2	FAIL
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*39.3 kWh/m^2*	
Dwelling fabric energy efficiency	37.3 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	35.11	0.14 **(!)**
Party wall: Party Wall (1)	20.24	0 **(!)**
Party wall: Party Wall (2)	27.66	0 **(!)**
Exposed roof: Roof (1)	64.73	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	2.11	North West	0.83	1.3
NW, Opening Type 1	10.56	North East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	
External wall	E15: Flat roof with parapet	Calculated by person with suitable expertise	0.56	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.12	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.85 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 363 L07_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 363 L07_Copy	**Prop Type Ref**	Unit 363 L07
Property			

SAP Rating	70 C	**DER**	7.79	**TER**	15.34
Environmental	94 A	**% DER < TER**			49.22
CO_2 Emissions (t/year)	0.51	**DFEE**	37.34	**TFEE**	39.30
Compliance Check	See BREL	**% DFEE < TFEE**			5.00
% DPER < TPER	-2.05	**DPER**	84.51	**TPER**	82.81

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7300 (1b)	x	2.4000 (2b)	=	155.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.7300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	155.3520	(5)

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2. Ventilation rate

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	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			12.6700	1.2357	15.6568			(27)
External Wall 1	47.7800	12.6700	35.1100	0.1400	4.9154	14.0000	491.5400	(29a)
External Roof 1	64.7300		64.7300	0.1100	7.1203	9.0000	582.5700	(30)
Total net area of external elements Aum(A, m2)			112.5100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.6925			(33)
Party Wall 1			20.2400	0.0000	0.0000	20.0000	404.8000	(32)
Wall to corridor			27.6600	0.0000	0.0000	20.0000	553.2000	(32)
Party Floor 1			64.7300			80.0000	5178.4000	(32d)
Internal Wall 1			115.6100			9.0000	1040.4900	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	8251.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		127.4679 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.4600	0.0500	0.2730

E4 Jamb	27.8400	0.0500	1.3920
E7 Party floor between dwellings (in blocks of flats)	17.5800	0.0700	1.2306
E18 Party wall between dwellings	5.4000	0.0600	0.3240
E16 Corner (normal)	2.7000	0.0900	0.2430
E15 Flat roof with parapet	17.5800	0.5600	9.8448
P4 Party wall - Roof (insulation at ceiling level)	17.3700	0.1200	2.0844
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	17.3700	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 15.3918 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 43.0843 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.5112	15.3478	15.1844	14.3673	14.2039	13.3869	13.3869	13.2235	13.7137	14.2039	14.5308	14.8576	(38)

Heat transfer coeff

	58.5956	58.4322	58.2687	57.4517	57.2883	56.4712	56.4712	56.3078	56.7980	57.2883	57.6151	57.9419	(39)

Average = Sum(39)m / 12 = 57.4108

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9052	0.9027	0.9002	0.8876	0.8850	0.8724	0.8724	0.8699	0.8775	0.8850	0.8901	0.8951	(40)
HLP (average)												0.8869	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1117 (42)

Hot water usage for mixer showers

	81.9864	80.7543	78.9589	75.5237	72.9887	70.1616	68.5546	70.3365	72.2897	75.3251	78.8341	81.6723	(42a)

Hot water usage for baths

	25.7646	25.3819	24.8431	23.8496	23.1056	22.2807	21.8352	22.3702	22.9528	23.8355	24.8495	25.6775	(42b)

Hot water usage for other uses

	36.2563	34.9379	33.6195	32.3011	30.9827	29.6642	29.6642	30.9827	32.3011	33.6195	34.9379	36.2563	(42c)

Average daily hot water use (litres/day) 132.4368 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.0073	141.0742	137.4215	131.6744	127.0770	122.1065	120.0540	123.6893	127.5435	132.7801	138.6214	143.6061	(44)
Energy conte	228.0724	200.8877	211.2117	180.2557	171.0700	150.1442	145.1950	153.1532	157.2739	180.1813	197.4917	224.8524	(45)

Energy content (annual) Total = Sum(45)m = 2199.7893

Distribution loss (46)m = 0.15 x (45)m

	34.2109	30.1332	31.6818	27.0383	25.6605	22.5216	21.7792	22.9730	23.5911	27.0272	29.6237	33.7279	(46)

Water storage loss:

Store volume 143.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)

Temperature factor from Table 2b 0.6000 (49)

Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	249.0532	219.8381	232.1925	200.5597	192.0508	170.4482	166.1758	174.1340	177.5779	201.1621	217.7957	245.8332	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

	249.0532	219.8381	232.1925	200.5597	192.0508	170.4482	166.1758	174.1340	177.5779	201.1621	217.7957	245.8332	(64)

Total per year (kWh/year) = Sum(64)m = 2446.8213 (64)

Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

	92.6187	81.9555	87.0125	76.1782	73.6654	66.1662	65.0620	67.7081	68.5368	76.6949	81.9092	91.5481	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	126.7042	126.7042	126.7042	126.7042	126.7042	126.7042	126.7042	126.7042	126.7042	126.7042	126.7042	126.7042	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	21.2608	18.8836	15.3572	11.6264	8.6909	7.3372	7.9281	10.3052	13.8317	17.5625	20.4980	21.8517	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	275.6710	278.5316	271.3230	255.9767	236.6047	218.3978	206.2345	203.3739	210.5825	225.9288	245.3008	263.5077	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	49.7822	49.7822	49.7822	49.7822	49.7822	49.7822	49.7822	49.7822	49.7822	49.7822	49.7822	49.7822	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-84.4695	-84.4695	-84.4695	-84.4695	-84.4695	-84.4695	-84.4695	-84.4695	-84.4695	-84.4695	-84.4695	-84.4695	(71)

Water heating gains (Table 5)

	124.4875	121.9576	116.9523	105.8031	99.0127	91.8974	87.4489	91.0055	95.1900	103.0846	113.7627	123.0485	(72)

Total internal gains

	513.4362	511.3897	495.6494	465.4230	436.3251	409.6493	393.6283	396.7015	411.6210	438.5927	471.5784	500.4247	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.5600	11.2829	0.6300	0.8270	0.7700	43.0195	(75)
Northwest	2.1100	11.2829	0.6300	0.8270	0.7700	8.5958	(81)

Solar gains	51.6153	105.0644	189.2926	310.8728	417.8741	445.4980	416.7542	332.2413	230.6560	128.3970	64.9454	42.1516	(83)
Total gains	565.0514	616.4541	684.9420	776.2958	854.1992	855.1473	810.3826	728.9428	642.2770	566.9898	536.5238	542.5763	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.1146	39.2240	39.3340	39.8934	40.0072	40.5861	40.5861	40.7038	40.3525	40.0072	39.7803	39.5559	
alpha	3.6076	3.6149	3.6223	3.6596	3.6671	3.7057	3.7057	3.7136	3.6902	3.6671	3.6520	3.6371	
util living area	0.9367	0.9128	0.8575	0.7401	0.5770	0.4124	0.3039	0.3504	0.5676	0.8048	0.9095	0.9434	(86)
MIT	19.6900	19.8968	20.2477	20.6462	20.8829	20.9743	20.9936	20.9894	20.9194	20.5906	20.0833	19.6498	(87)
Th 2	20.1631	20.1652	20.1673	20.1781	20.1802	20.1910	20.1910	20.1932	20.1867	20.1802	20.1759	20.1716	(88)
util rest of house	0.9276	0.9007	0.8385	0.7095	0.5354	0.3634	0.2491	0.2908	0.5115	0.7728	0.8950	0.9352	(89)
MIT 2	18.6464	18.9043	19.3351	19.8126	20.0729	20.1721	20.1876	20.1872	20.1219	19.7634	19.1489	18.6026	(90)
Living area fraction										fLA = Living area / (4) =		0.4048	(91)
MIT	19.0688	19.3060	19.7045	20.1500	20.4008	20.4968	20.5139	20.5119	20.4447	20.0982	19.5271	19.0265	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0688	19.3060	19.7045	20.1500	20.4008	20.4968	20.5139	20.5119	20.4447	20.0982	19.5271	19.0265	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9133	0.8862	0.8267	0.7084	0.5469	0.3821	0.2711	0.3145	0.5298	0.7693	0.8817	0.9214	(94)
Useful gains	516.0421	546.2808	566.2668	549.9465	467.1194	326.7536	219.7137	229.2865	340.2812	436.1774	473.0648	499.9332	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	865.3845	841.7732	769.4081	646.3312	498.4511	332.9980	221.0202	231.5299	360.3661	544.1362	715.9882	859.0733	(97)
Space heating kWh	259.9108	198.5708	151.1371	69.3969	23.3108	0.0000	0.0000	0.0000	0.0000	80.3214	174.9048	267.2002	(98a)
Space heating requirement - total per year (kWh/year)												1224.7529	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	259.9108	198.5708	151.1371	69.3969	23.3108	0.0000	0.0000	0.0000	0.0000	80.3214	174.9048	267.2002	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1224.7529	
Space heating per m2											(98c) / (4) =	18.9209	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 100.0000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	259.9108	198.5708	151.1371	69.3969	23.3108	0.0000	0.0000	0.0000	0.0000	80.3214	174.9048	267.2002	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	259.9108	198.5708	151.1371	69.3969	23.3108	0.0000	0.0000	0.0000	0.0000	80.3214	174.9048	267.2002	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	249.0532	219.8381	232.1925	200.5597	192.0508	170.4482	166.1758	174.1340	177.5779	201.1621	217.7957	245.8332	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	249.0532	219.8381	232.1925	200.5597	192.0508	170.4482	166.1758	174.1340	177.5779	201.1621	217.7957	245.8332	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.2679	10.1775	11.2679	10.9044	11.2679	10.9044	11.2679	11.2679	10.9044	11.2679	10.9044	11.2679	(231)
Lighting	18.6094	14.9292	13.4421	9.8482	7.6071	6.2150	6.9394	9.0201	11.7162	15.3723	17.3630	19.1266	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.0484	-25.7324	-41.9017	-52.2297	-60.2921	-57.2279	-56.3170	-50.8340	-41.5226	-31.1216	-18.5379	-13.5058	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.6862	-6.3844	-14.6960	-25.7759	-37.5020	-39.3924	-38.8347	-31.4364	-21.4714	-10.4877	-3.8613	-2.0474	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year
Space heating fuel - main system 1 1224.7529 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 100.0000
Water heating fuel used 2446.8213 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)
mechanical ventilation fans (SFP = 0.7000) 132.6706 (230a)
Total electricity for the above, kWh/year 132.6706 (231)
Electricity for lighting (calculated in Appendix L) 150.1887 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation -699.8470 (233)

Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3254.5865	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1224.7529	16.4900	201.9617	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2446.8213	16.4900	403.4808	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	132.6706	16.4900	21.8774	(249)
Energy for lighting	150.1887	16.4900	24.7661	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-465.2711	16.4900	-76.7232	
PV Unit electricity exported	-234.5759	5.5900	-13.1128	
Total			-89.8360	(252)
Total energy cost			562.2501	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.8446	(257)
SAP value		70.0987	
SAP rating (Section 12)		70	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1224.7529	0.1561	191.1495	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2446.8213	0.1413	345.7088	(264)
Space and water heating			536.8583	(265)
Pumps, fans and electric keep-hot	132.6706	0.1387	18.4030	(267)
Energy for lighting	150.1887	0.1443	21.6769	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-465.2711	0.1326	-61.6823	
PV Unit electricity exported	-234.5759	0.1220	-28.6299	
Total			-90.3122	(269)
Total CO2, kg/year			486.6260	(272)
CO2 emissions per m2			7.5200	(273)
EI value			94.0574	
EI rating			94	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		64.7300 (1b)	x	2.4000 (2b)	=	155.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.7300						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	155.3520	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			12.6700	1.2357	15.6568			(27)
External Wall 1	47.7800	12.6700	35.1100	0.1400	4.9154	14.0000	491.5400	(29a)
External Roof 1	64.7300		64.7300	0.1100	7.1203	9.0000	582.5700	(30)
Total net area of external elements Aum(A, m2)			112.5100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.6925			(33)
Party Wall 1			20.2400	0.0000	0.0000	20.0000	404.8000	(32)
Wall to corridor			27.6600	0.0000	0.0000	20.0000	553.2000	(32)
Party Floor 1			64.7300			80.0000	5178.4000	(32d)
Internal Wall 1			115.6100			9.0000	1040.4900	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 8251.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 127.4679 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.4600	0.0500	0.2730
E4 Jamb	27.8400	0.0500	1.3920
E7 Party floor between dwellings (in blocks of flats)	17.5800	0.0700	1.2306
E18 Party wall between dwellings	5.4000	0.0600	0.3240
E16 Corner (normal)	2.7000	0.0900	0.2430
E15 Flat roof with parapet	17.5800	0.5600	9.8448
P4 Party wall - Roof (insulation at ceiling level)	17.3700	0.1200	2.0844
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	17.3700	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 15.3918 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 43.0843 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.6746	15.6746	15.3478	14.3673	14.2039	13.5503	13.2235	13.2235	13.8771	14.6942	15.0210	14.8576	(38)
Heat transfer coeff	58.7590	58.7590	58.4322	57.4517	57.2883	56.6346	56.3078	56.3078	56.9615	57.7785	58.1053	57.9419	(39)

Average = Sum(39)m / 12 = 57.5606

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9078	0.9078	0.9027	0.8876	0.8850	0.8749	0.8699	0.8699	0.8800	0.8926	0.8977	0.8951	(40)
HLP (average)												0.8892	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1117 (42)
Hot water usage for mixer showers

81.9864	80.7543	78.9589	75.5237	72.9887	70.1616	68.5546	70.3365	72.2897	75.3251	78.8341	81.6723	(42a)

Hot water usage for baths

25.7646	25.3819	24.8431	23.8496	23.1056	22.2807	21.8352	22.3702	22.9528	23.8355	24.8495	25.6775	(42b)

Hot water usage for other uses

36.2563	34.9379	33.6195	32.3011	30.9827	29.6642	29.6642	30.9827	32.3011	33.6195	34.9379	36.2563	(42c)

Average daily hot water use (litres/day) 132.4368 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.0073	141.0742	137.4215	131.6744	127.0770	122.1065	120.0540	123.6893	127.5435	132.7801	138.6214	143.6061	(44)
Energy conte	228.0724	200.8877	211.2117	180.2557	171.0700	150.1442	145.1950	153.1532	157.2739	180.1813	197.4917	224.8524	(45)

Energy content (annual) Total = Sum(45)m = 2199.7893

Distribution loss (46)m = 0.15 x (45)m												
34.2109	30.1332	31.6818	27.0383	25.6605	22.5216	21.7792	22.9730	23.5911	27.0272	29.6237	33.7279	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

249.0532	219.8381	232.1925	200.5597	192.0508	170.4482	166.1758	174.1340	177.5779	201.1621	217.7957	245.8332	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h												
249.0532	219.8381	232.1925	200.5597	192.0508	170.4482	166.1758	174.1340	177.5779	201.1621	217.7957	245.8332	(64)

Total per year (kWh/year) = Sum(64)m = 2446.8213 (64)

Electric shower(s)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month												
92.6187	81.9555	87.0125	76.1782	73.6654	66.1662	65.0620	67.7081	68.5368	76.6949	81.9092	91.5481	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	126.7042	126.7042	126.7042	126.7042	126.7042	126.7042	126.7042	126.7042	126.7042	126.7042	126.7042	126.7042	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.2608	18.8836	15.3572	11.6264	8.6909	7.3372	7.9281	10.3052	13.8317	17.5625	20.4980	21.8517	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.6710	278.5316	271.3230	255.9767	236.6047	218.3978	206.2345	203.3739	210.5825	225.9288	245.3008	263.5077	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.7822	49.7822	49.7822	49.7822	49.7822	49.7822	49.7822	49.7822	49.7822	49.7822	49.7822	49.7822	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-84.4695	-84.4695	-84.4695	-84.4695	-84.4695	-84.4695	-84.4695	-84.4695	-84.4695	-84.4695	-84.4695	-84.4695	(71)
Water heating gains (Table 5)													
	124.4875	121.9576	116.9523	105.8031	99.0127	91.8974	87.4489	91.0055	95.1900	103.0846	113.7627	123.0485	(72)
Total internal gains													
	513.4362	511.3897	495.6494	465.4230	436.3251	409.6493	393.6283	396.7015	411.6210	438.5927	471.5784	500.4247	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.5600	10.0309	0.6300	0.8270	0.7700	38.2458	(75)
Northwest	2.1100	10.0309	0.6300	0.8270	0.7700	7.6419	(81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	45.8877	99.3455	186.7297	323.5438	432.6596	449.5503	425.2383	328.1561	225.6368	120.5412	59.2695	38.3705	(83)
Total gains	559.3239	610.7352	682.3791	788.9668	868.9848	859.1996	818.8667	724.8576	637.2578	559.1340	530.8479	538.7952	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	39.0059	39.0059	39.2240	39.8934	40.0072	40.4690	40.7038	40.7038	40.2368	39.6678	39.4447	39.5559	
alpha	3.6004	3.6004	3.6149	3.6596	3.6671	3.6979	3.7136	3.7136	3.6825	3.6445	3.6296	3.6371	
util living area													
	0.9423	0.9228	0.8767	0.7665	0.6160	0.4918	0.4096	0.4645	0.6516	0.8410	0.9202	0.9488	(86)
MIT	19.6082	19.7831	20.1198	20.5663	20.8392	20.9435	20.9763	20.9634	20.8476	20.4652	19.9821	19.5631	(87)
Th 2	20.1609	20.1609	20.1652	20.1781	20.1802	20.1889	20.1932	20.1932	20.1845	20.1738	20.1695	20.1716	(88)
util rest of house													
	0.9341	0.9122	0.8605	0.7394	0.5779	0.4462	0.3585	0.4092	0.6034	0.8146	0.9074	0.9414	(89)
MIT 2	18.5420	18.7594	19.1770	19.7189	20.0262	20.1417	20.1762	20.1663	20.0482	19.6114	19.0190	18.4931	(90)
Living area fraction									fLA = Living area / (4) =			0.4048	(91)
MIT	18.9736	19.1738	19.5586	20.0619	20.3553	20.4663	20.5000	20.4890	20.3718	19.9570	19.4088	18.9262	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9736	19.1738	19.5586	20.0619	20.3553	20.4663	20.5000	20.4890	20.3718	19.9570	19.4088	18.9262	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9199	0.8974	0.8472	0.7354	0.5863	0.4620	0.3782	0.4298	0.6149	0.8069	0.8936	0.9279	(94)
Useful gains	514.5299	548.0628	578.0944	580.1689	509.4715	396.9697	309.6590	311.5305	391.8505	451.1729	474.3889	499.9525	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	885.7070	873.9664	815.6312	698.7236	553.1334	411.5217	315.3257	320.3332	431.3005	592.6331	744.2613	882.2347	(97)
Space heating kWh													
	276.1558	219.0072	176.7274	85.3594	32.4845	0.0000	0.0000	0.0000	0.0000	105.2464	194.3081	284.4180	(98a)
Space heating requirement - total per year (kWh/year)												1373.7068	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	276.1558	219.0072	176.7274	85.3594	32.4845	0.0000	0.0000	0.0000	0.0000	105.2464	194.3081	284.4180	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1373.7068	
Space heating per m2											(98c) / (4) =	21.2221	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	276.1558	219.0072	176.7274	85.3594	32.4845	0.0000	0.0000	0.0000	0.0000	105.2464	194.3081	284.4180	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	276.1558	219.0072	176.7274	85.3594	32.4845	0.0000	0.0000	0.0000	0.0000	105.2464	194.3081	284.4180	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating
Water heating requirement

	249.0532	219.8381	232.1925	200.5597	192.0508	170.4482	166.1758	174.1340	177.5779	201.1621	217.7957	245.8332 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	249.0532	219.8381	232.1925	200.5597	192.0508	170.4482	166.1758	174.1340	177.5779	201.1621	217.7957	245.8332 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	11.2679	10.1775	11.2679	10.9044	11.2679	10.9044	11.2679	11.2679	10.9044	11.2679	10.9044	11.2679 (231)
Lighting	18.6094	14.9292	13.4421	9.8482	7.6071	6.2150	6.9394	9.0201	11.7162	15.3723	17.3630	19.1266 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-14.5280	-24.8075	-42.1452	-54.8457	-62.7675	-58.0583	-57.6189	-50.8495	-41.2491	-30.0041	-17.2534	-12.4784 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.2631	-5.8939	-14.4331	-27.4270	-39.6836	-40.4851	-40.5595	-31.4541	-21.2185	-9.5326	-3.3725	-1.7819 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	1373.7068 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2446.8213 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	132.6706 (230a)
Total electricity for the above, kWh/year	132.6706 (231)
Electricity for lighting (calculated in Appendix L)	150.1887 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-704.7104 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3398.6770 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1373.7068	25.1600	345.6246	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2446.8213	25.1600	615.6202	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	132.6706	25.1600	33.3799	(249)
Energy for lighting	150.1887	25.1600	37.7875	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-466.6056	25.1600	-117.3980	
PV Unit electricity exported	-238.1047	5.8100	-13.8339	
Total			-131.2319	(252)
Total energy cost			901.1804	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1373.7068	0.1555	213.6023	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2446.8213	0.1413	345.7088	(264)
Space and water heating			559.3111	(265)
Pumps, fans and electric keep-hot	132.6706	0.1387	18.4030	(267)
Energy for lighting	150.1887	0.1443	21.6769	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-466.6056	0.1323	-61.7238	
PV Unit electricity exported	-238.1047	0.1215	-28.9233	
Total			-90.6471	(269)
Total CO2, kg/year			508.7440	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1373.7068	1.5757	2164.5220	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2446.8213	1.5225	3725.1745	(278)
Space and water heating			5889.6965	(279)
Pumps, fans and electric keep-hot	132.6706	1.5128	200.7041	(281)
Energy for lighting	150.1887	1.5338	230.3645	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-466.6056	1.4888	-694.6724	
PV Unit electricity exported	-238.1047	0.4457	-106.1214	
Total			-800.7938	(283)
Total Primary energy kWh/year			5519.9713	(286)

SAP 10 EPC IMPROVEMENTS

Unit 363 L07_Copy

Current energy efficiency rating: C 70
Current environmental impact rating: A 94

N Solar water heating	Not applicable
U Solar photovoltaic panels	Not applicable
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 70
Potential environmental impact rating: A 94

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£1032	£1032	£0
Space heating	£379	£379	£0
Water heating	£616	£616	£0
Lighting	£38	£38	£0
Generated (PV)	-£131	-£131	£0
Total cost of fuels	£901	£901	£0
Total cost of uses	£902	£902	£0
Delivered energy	53 kWh/m²	53 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.5 tonnes	0.0 tonnes
CO2 emissions per m²	8 kg/m²	8 kg/m²	0 kg/m²
Primary energy	85 kWh/m²	85 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7300 (1b)	x	2.4000 (2b)	=	155.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.7300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	155.3520	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor (20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20)	=	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			12.6700	1.2357	15.6568			(27)
External Wall 1	47.7800	12.6700	35.1100	0.1400	4.9154	14.0000	491.5400	(29a)
External Roof 1	64.7300		64.7300	0.1100	7.1203	9.0000	582.5700	(30)
Total net area of external elements Aum(A, m2)			112.5100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.6925			(33)
Party Wall 1			20.2400	0.0000	0.0000	20.0000	404.8000	(32)
Wall to corridor			27.6600	0.0000	0.0000	20.0000	553.2000	(32)
Party Floor 1			64.7300			80.0000	5178.4000	(32d)
Internal Wall 1			115.6100			9.0000	1040.4900	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	8251.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		127.4679 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.4600	0.0500	0.2730
E4 Jamb	27.8400	0.0500	1.3920
E7 Party floor between dwellings (in blocks of flats)	17.5800	0.0700	1.2306
E18 Party wall between dwellings	5.4000	0.0600	0.3240
E16 Corner (normal)	2.7000	0.0900	0.2430
E15 Flat roof with parapet	17.5800	0.5600	9.8448
P4 Party wall - Roof (insulation at ceiling level)	17.3700	0.1200	2.0844
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	17.3700	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		15.3918 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	43.0843 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.5112	15.3478	15.1844	14.3673	14.2039	13.3869	13.3869	13.2235	13.7137	14.2039	14.5308	14.8576	(38)
Heat transfer coeff	58.5956	58.4322	58.2687	57.4517	57.2883	56.4712	56.4712	56.3078	56.7980	57.2883	57.6151	57.9419	(39)
Average = Sum(39)m / 12 =												57.4108	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9052	0.9027	0.9002	0.8876	0.8850	0.8724	0.8724	0.8699	0.8775	0.8850	0.8901	0.8951	(40)
HLP (average)												0.8869	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.1117 (42)
Hot water usage for mixer showers	81.9864	80.7543	78.9589	75.5237	72.9887	70.1616	68.5546	70.3365	72.2897	75.3251	78.8341	81.6723 (42a)
Hot water usage for baths	25.7646	25.3819	24.8431	23.8496	23.1056	22.2807	21.8352	22.3702	22.9528	23.8355	24.8495	25.6775 (42b)
Hot water usage for other uses	36.2563	34.9379	33.6195	32.3011	30.9827	29.6642	29.6642	30.9827	32.3011	33.6195	34.9379	36.2563 (42c)
Average daily hot water use (litres/day)												132.4368 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.0073	141.0742	137.4215	131.6744	127.0770	122.1065	120.0540	123.6893	127.5435	132.7801	138.6214	143.6061	(44)
Energy conte	228.0724	200.8877	211.2117	180.2557	171.0700	150.1442	145.1950	153.1532	157.2739	180.1813	197.4917	224.8524	(45)
Energy content (annual)										Total = Sum(45)m =		2199.7893	
Distribution loss (46)m = 0.15 x (45)m	34.2109	30.1332	31.6818	27.0383	25.6605	22.5216	21.7792	22.9730	23.5911	27.0272	29.6237	33.7279	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	249.0532	219.8381	232.1925	200.5597	192.0508	170.4482	166.1758	174.1340	177.5779	201.1621	217.7957	245.8332	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	249.0532	219.8381	232.1925	200.5597	192.0508	170.4482	166.1758	174.1340	177.5779	201.1621	217.7957	245.8332	(64)
										Total per year (kWh/year) = Sum(64)m =		2446.8213	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	92.6187	81.9555	87.0125	76.1782	73.6654	66.1662	65.0620	67.7081	68.5368	76.6949	81.9092	91.5481	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	126.7042	126.7042	126.7042	126.7042	126.7042	126.7042	126.7042	126.7042	126.7042	126.7042	126.7042	126.7042	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.2608	18.8836	15.3572	11.6264	8.6909	7.3372	7.9281	10.3052	13.8317	17.5625	20.4980	21.8517	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	275.6710	278.5316	271.3230	255.9767	236.6047	218.3978	206.2345	203.3739	210.5825	225.9288	245.3008	263.5077	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.7822	49.7822	49.7822	49.7822	49.7822	49.7822	49.7822	49.7822	49.7822	49.7822	49.7822	49.7822	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)													
	-84.4695	-84.4695	-84.4695	-84.4695	-84.4695	-84.4695	-84.4695	-84.4695	-84.4695	-84.4695	-84.4695	-84.4695	(71)
Water heating gains (Table 5)													
	124.4875	121.9576	116.9523	105.8031	99.0127	91.8974	87.4489	91.0055	95.1900	103.0846	113.7627	123.0485	(72)
Total internal gains													
	513.4362	511.3897	495.6494	465.4230	436.3251	409.6493	393.6283	396.7015	411.6210	438.5927	471.5784	500.4247	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.5600	11.2829	0.6300	0.8270	0.7700	43.0195	(75)
Northwest	2.1100	11.2829	0.6300	0.8270	0.7700	8.5958	(81)

Solar gains	51.6153	105.0644	189.2926	310.8728	417.8741	445.4980	416.7542	332.2413	230.6560	128.3970	64.9454	42.1516	(83)
Total gains	565.0514	616.4541	684.9420	776.2958	854.1992	855.1473	810.3826	728.9428	642.2770	566.9898	536.5238	542.5763	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.1146	39.2240	39.3340	39.8934	40.0072	40.5861	40.5861	40.7038	40.3525	40.0072	39.7803	39.5559	
alpha	3.6076	3.6149	3.6223	3.6596	3.6671	3.7057	3.7057	3.7136	3.6902	3.6671	3.6520	3.6371	
util living area													
	0.9367	0.9128	0.8575	0.7401	0.5770	0.4124	0.3039	0.3504	0.5676	0.8048	0.9095	0.9434	(86)
MIT	19.6900	19.8968	20.2477	20.6462	20.8829	20.9743	20.9936	20.9894	20.9194	20.5906	20.0833	19.6498	(87)
Th 2	20.1631	20.1652	20.1673	20.1781	20.1802	20.1910	20.1910	20.1932	20.1867	20.1802	20.1759	20.1716	(88)
util rest of house													
	0.9276	0.9007	0.8385	0.7095	0.5354	0.3634	0.2491	0.2908	0.5115	0.7728	0.8950	0.9352	(89)
MIT 2	18.6464	18.9043	19.3351	19.8126	20.0729	20.1721	20.1876	20.1872	20.1219	19.7634	19.1489	18.6026	(90)
Living area fraction									fLA = Living area / (4) =			0.4048	(91)
MIT	19.0688	19.3060	19.7045	20.1500	20.4008	20.4968	20.5139	20.5119	20.4447	20.0982	19.5271	19.0265	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0688	19.3060	19.7045	20.1500	20.4008	20.4968	20.5139	20.5119	20.4447	20.0982	19.5271	19.0265	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9133	0.8862	0.8267	0.7084	0.5469	0.3821	0.2711	0.3145	0.5298	0.7693	0.8817	0.9214	(94)
Useful gains	516.0421	546.2808	566.2668	549.9465	467.1194	326.7536	219.7137	229.2865	340.2812	436.1774	473.0648	499.9332	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	865.3845	841.7732	769.4081	646.3312	498.4511	332.9980	221.0202	231.5299	360.3661	544.1362	715.9882	859.0733	(97)
Space heating kWh													
	259.9108	198.5708	151.1371	69.3969	23.3108	0.0000	0.0000	0.0000	0.0000	80.3214	174.9048	267.2002	(98a)
Space heating requirement - total per year (kWh/year)												1224.7529	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	259.9108	198.5708	151.1371	69.3969	23.3108	0.0000	0.0000	0.0000	0.0000	80.3214	174.9048	267.2002	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1224.7529	
Space heating per m2											(98c) / (4) =	18.9209	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	259.9108	198.5708	151.1371	69.3969	23.3108	0.0000	0.0000	0.0000	0.0000	80.3214	174.9048	267.2002	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	259.9108	198.5708	151.1371	69.3969	23.3108	0.0000	0.0000	0.0000	0.0000	80.3214	174.9048	267.2002	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	249.0532	219.8381	232.1925	200.5597	192.0508	170.4482	166.1758	174.1340	177.5779	201.1621	217.7957	245.8332	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	249.0532	219.8381	232.1925	200.5597	192.0508	170.4482	166.1758	174.1340	177.5779	201.1621	217.7957	245.8332	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.2679	10.1775	11.2679	10.9044	11.2679	10.9044	11.2679	11.2679	10.9044	11.2679	10.9044	11.2679	(231)
Lighting	18.6094	14.9292	13.4421	9.8482	7.6071	6.2150	6.9394	9.0201	11.7162	15.3723	17.3630	19.1266	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.0484	-25.7324	-41.9017	-52.2297	-60.2921	-57.2279	-56.3170	-50.8340	-41.5226	-31.1216	-18.5379	-13.5058	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.6862	-6.3844	-14.6960	-25.7759	-37.5020	-39.3924	-38.8347	-31.4364	-21.4714	-10.4877	-3.8613	-2.0474	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1224.7529	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2446.8213	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	132.6706	(230a)
Total electricity for the above, kWh/year	132.6706	(231)
Electricity for lighting (calculated in Appendix L)	150.1887	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-699.8470	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3254.5865	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1224.7529	16.4900	201.9617	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2446.8213	16.4900	403.4808	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	132.6706	16.4900	21.8774	(249)
Energy for lighting	150.1887	16.4900	24.7661	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-465.2711	16.4900	-76.7232	
PV Unit electricity exported	-234.5759	5.5900	-13.1128	
Total			-89.8360	(252)
Total energy cost			562.2501	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.8446	(257)
SAP value	70.0987	
SAP rating (Section 12)	70	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1224.7529	0.1561	191.1495	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2446.8213	0.1413	345.7088	(264)
Space and water heating			536.8583	(265)
Pumps, fans and electric keep-hot	132.6706	0.1387	18.4030	(267)
Energy for lighting	150.1887	0.1443	21.6769	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-465.2711	0.1326	-61.6823	
PV Unit electricity exported	-234.5759	0.1220	-28.6299	
Total			-90.3122	(269)
Total CO2, kg/year			486.6260	(272)
CO2 emissions per m2			7.5200	(273)
EI value			94.0574	
EI rating			94	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7300	(1b)	x 2.4000	(2b) =	155.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.7300					(4)

Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 155.3520 (5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			12.6700	1.2357	15.6568			(27)
External Wall 1	47.7800	12.6700	35.1100	0.1400	4.9154	14.0000	491.5400	(29a)
External Roof 1	64.7300		64.7300	0.1100	7.1203	9.0000	582.5700	(30)
Total net area of external elements Aum(A, m2)			112.5100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.6925			(33)
Party Wall 1			20.2400	0.0000	0.0000	20.0000	404.8000	(32)
Wall to corridor			27.6600	0.0000	0.0000	20.0000	553.2000	(32)
Party Floor 1			64.7300			80.0000	5178.4000	(32d)
Internal Wall 1			115.6100			9.0000	1040.4900	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	8251.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		127.4679 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.4600	0.0500	0.2730
E4 Jamb	27.8400	0.0500	1.3920
E7 Party floor between dwellings (in blocks of flats)	17.5800	0.0700	1.2306
E18 Party wall between dwellings	5.4000	0.0600	0.3240
E16 Corner (normal)	2.7000	0.0900	0.2430
E15 Flat roof with parapet	17.5800	0.5600	9.8448
P4 Party wall - Roof (insulation at ceiling level)	17.3700	0.1200	2.0844
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	17.3700	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		15.3918 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	43.0843 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.6746	15.6746	15.3478	14.3673	14.2039	13.5503	13.2235	13.2235	13.8771	14.6942	15.0210	14.8576	(38)
Heat transfer coeff	58.7590	58.7590	58.4322	57.4517	57.2883	56.6346	56.3078	56.3078	56.9615	57.7785	58.1053	57.9419	(39)

Average = Sum(39)m / 12 = 57.5606

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9078	0.9078	0.9027	0.8876	0.8850	0.8749	0.8699	0.8699	0.8800	0.8926	0.8977	0.8951	(40)
HLP (average)												0.8892	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1117	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	81.9864	80.7543	78.9589	75.5237	72.9887	70.1616	68.5546	70.3365	72.2897	75.3251	78.8341	81.6723	(42a)
Hot water usage for baths	25.7646	25.3819	24.8431	23.8496	23.1056	22.2807	21.8352	22.3702	22.9528	23.8355	24.8495	25.6775	(42b)
Hot water usage for other uses	36.2563	34.9379	33.6195	32.3011	30.9827	29.6642	29.6642	30.9827	32.3011	33.6195	34.9379	36.2563	(42c)

Average daily hot water use (litres/day)	132.4368	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.0073	141.0742	137.4215	131.6744	127.0770	122.1065	120.0540	123.6893	127.5435	132.7801	138.6214	143.6061	(44)
Energy conte	228.0724	200.8877	211.2117	180.2557	171.0700	150.1442	145.1950	153.1532	157.2739	180.1813	197.4917	224.8524	(45)

Energy content (annual)	Total = Sum(45)m =	2199.7893
Distribution loss (46)m = 0.15 x (45)m		

	34.2109	30.1332	31.6818	27.0383	25.6605	22.5216	21.7792	22.9730	23.5911	27.0272	29.6237	33.7279	(46)

Water storage loss:

Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	249.0532	219.8381	232.1925	200.5597	192.0508	170.4482	166.1758	174.1340	177.5779	201.1621	217.7957	245.8332	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	249.0532	219.8381	232.1925	200.5597	192.0508	170.4482	166.1758	174.1340	177.5779	201.1621	217.7957	245.8332	(64)
									Total per year (kWh/year) = Sum(64)m =			2446.8213	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	92.6187	81.9555	87.0125	76.1782	73.6654	66.1662	65.0620	67.7081	68.5368	76.6949	81.9092	91.5481	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	126.7042	126.7042	126.7042	126.7042	126.7042	126.7042	126.7042	126.7042	126.7042	126.7042	126.7042	126.7042	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.2608	18.8836	15.3572	11.6264	8.6909	7.3372	7.9281	10.3052	13.8317	17.5625	20.4980	21.8517	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	275.6710	278.5316	271.3230	255.9767	236.6047	218.3978	206.2345	203.3739	210.5825	225.9288	245.3008	263.5077	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.7822	49.7822	49.7822	49.7822	49.7822	49.7822	49.7822	49.7822	49.7822	49.7822	49.7822	49.7822	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-84.4695	-84.4695	-84.4695	-84.4695	-84.4695	-84.4695	-84.4695	-84.4695	-84.4695	-84.4695	-84.4695	-84.4695	(71)
Water heating gains (Table 5)	124.4875	121.9576	116.9523	105.8031	99.0127	91.8974	87.4489	91.0055	95.1900	103.0846	113.7627	123.0485	(72)
Total internal gains	513.4362	511.3897	495.6494	465.4230	436.3251	409.6493	393.6283	396.7015	411.6210	438.5927	471.5784	500.4247	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.5600	10.0309	0.6300	0.8270	0.7700	38.2458	(75)
Northwest	2.1100	10.0309	0.6300	0.8270	0.7700	7.6419	(81)

Solar gains	45.8877	99.3455	186.7297	323.5438	432.6596	449.5503	425.2383	328.1561	225.6368	120.5412	59.2695	38.3705	(83)
Total gains	559.3239	610.7352	682.3791	788.9668	868.9848	859.1996	818.8667	724.8576	637.2578	559.1340	530.8479	538.7952	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.0059	39.0059	39.2240	39.8934	40.0072	40.4690	40.7038	40.7038	40.2368	39.6678	39.4447	39.5559	
alpha	3.6004	3.6004	3.6149	3.6596	3.6671	3.6979	3.7136	3.7136	3.6825	3.6445	3.6296	3.6371	
util living area	0.9423	0.9228	0.8767	0.7665	0.6160	0.4918	0.4096	0.4645	0.6516	0.8410	0.9202	0.9488	(86)
MIT	19.6082	19.7831	20.1198	20.5663	20.8392	20.9435	20.9763	20.9634	20.8476	20.4652	19.9821	19.5631	(87)
Th 2	20.1609	20.1609	20.1652	20.1781	20.1802	20.1889	20.1932	20.1932	20.1845	20.1738	20.1695	20.1716	(88)
util rest of house	0.9341	0.9122	0.8605	0.7394	0.5779	0.4462	0.3585	0.4092	0.6034	0.8146	0.9074	0.9414	(89)
MIT 2	18.5420	18.7594	19.1770	19.7189	20.0262	20.1417	20.1762	20.1663	20.0482	19.6114	19.0190	18.4931	(90)
Living area fraction									fLA = Living area / (4) =			0.4048	(91)
MIT	18.9736	19.1738	19.5586	20.0619	20.3553	20.4663	20.5000	20.4890	20.3718	19.9570	19.4088	18.9262	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9736	19.1738	19.5586	20.0619	20.3553	20.4663	20.5000	20.4890	20.3718	19.9570	19.4088	18.9262	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9199	0.8974	0.8472	0.7354	0.5863	0.4620	0.3782	0.4298	0.6149	0.8069	0.8936	0.9279	(94)
Useful gains	514.5299	548.0628	578.0944	580.1689	509.4715	396.9697	309.6590	311.5305	391.8505	451.1729	474.3889	499.9525	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	885.7070	873.9664	815.6312	698.7236	553.1334	411.5217	315.3257	320.3332	431.3005	592.6331	744.2613	882.2347	(97)
Space heating kWh	276.1558	219.0072	176.7274	85.3594	32.4845	0.0000	0.0000	0.0000	0.0000	105.2464	194.3081	284.4180	(98a)
Space heating requirement - total per year (kWh/year)												1373.7068	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	276.1558	219.0072	176.7274	85.3594	32.4845	0.0000	0.0000	0.0000	0.0000	105.2464	194.3081	284.4180	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1373.7068	
Space heating per m2											(98c) / (4) =	21.2221	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	276.1558	219.0072	176.7274	85.3594	32.4845	0.0000	0.0000	0.0000	0.0000	105.2464	194.3081	284.4180	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	276.1558	219.0072	176.7274	85.3594	32.4845	0.0000	0.0000	0.0000	0.0000	105.2464	194.3081	284.4180	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	249.0532	219.8381	232.1925	200.5597	192.0508	170.4482	166.1758	174.1340	177.5779	201.1621	217.7957	245.8332	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	249.0532	219.8381	232.1925	200.5597	192.0508	170.4482	166.1758	174.1340	177.5779	201.1621	217.7957	245.8332	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.2679	10.1775	11.2679	10.9044	11.2679	10.9044	11.2679	11.2679	10.9044	11.2679	10.9044	11.2679	(231)
Lighting	18.6094	14.9292	13.4421	9.8482	7.6071	6.2150	6.9394	9.0201	11.7162	15.3723	17.3630	19.1266	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.5280	-24.8075	-42.1452	-54.8457	-62.7675	-58.0583	-57.6189	-50.8495	-41.2491	-30.0041	-17.2534	-12.4784	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.2631	-5.8939	-14.4331	-27.4270	-39.6836	-40.4851	-40.5595	-31.4541	-21.2185	-9.5326	-3.3725	-1.7819	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1373.7068	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2446.8213	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)													
mechanical ventilation fans (SFP = 0.7000)												132.6706	(230a)
Total electricity for the above, kWh/year												132.6706	(231)
Electricity for lighting (calculated in Appendix L)												150.1887	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-704.7104	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3398.6770	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1373.7068	25.1600	345.6246	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2446.8213	25.1600	615.6202	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	132.6706	25.1600	33.3799	(249)
Energy for lighting	150.1887	25.1600	37.7875	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-466.6056	25.1600	-117.3980	
PV Unit electricity exported	-238.1047	5.8100	-13.8339	
Total			-131.2319	(252)
Total energy cost			901.1804	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1373.7068	0.1555	213.6023	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2446.8213	0.1413	345.7088	(264)
Space and water heating			559.3111	(265)
Pumps, fans and electric keep-hot	132.6706	0.1387	18.4030	(267)
Energy for lighting	150.1887	0.1443	21.6769	(268)
Energy saving/generation technologies				

PV Unit electricity used in dwelling	-466.6056	0.1323	-61.7238	
PV Unit electricity exported	-238.1047	0.1215	-28.9233	
Total			-90.6471	(269)
Total CO2, kg/year			508.7440	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1373.7068	1.5757	2164.5220	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2446.8213	1.5225	3725.1745	(278)
Space and water heating			5889.6965	(279)
Pumps, fans and electric keep-hot	132.6706	1.5128	200.7041	(281)
Energy for lighting	150.1887	1.5338	230.3645	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-466.6056	1.4888	-694.6724	
PV Unit electricity exported	-238.1047	0.4457	-106.1214	
Total			-800.7938	(283)
Total Primary energy kWh/year			5519.9713	(286)

Predicted Energy Assessment

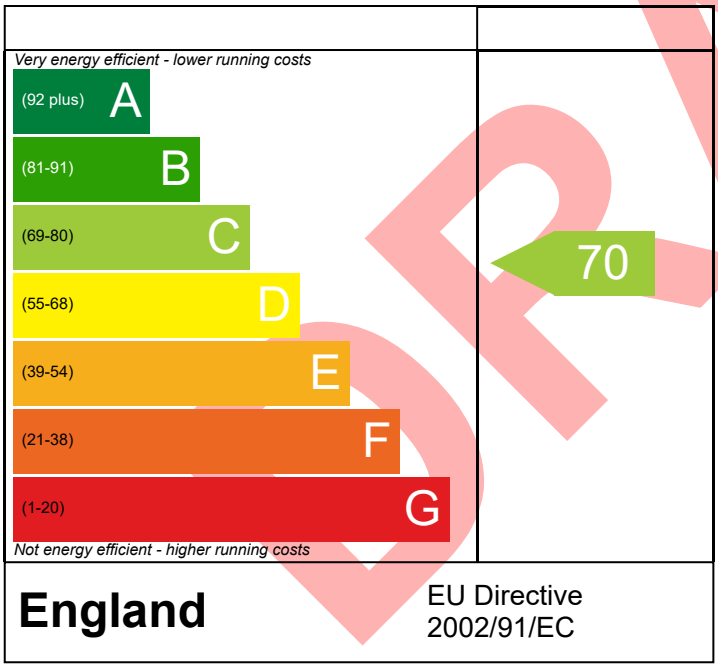
elmhurst energy

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	64.73 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

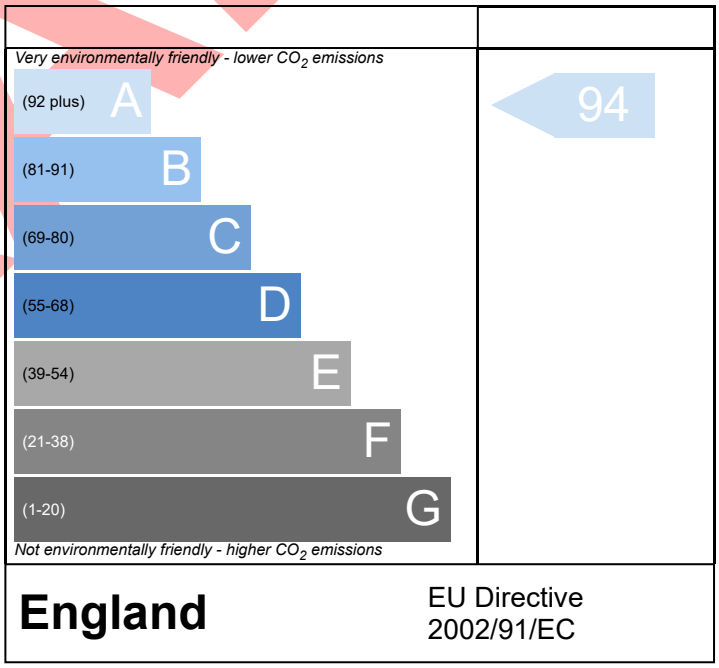
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:57

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	73 m^2
Site Reference	Unit 364 L07_Copy	Plot Reference	Unit 364 L07_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.96 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	5.63 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*64.66 kWh$_{PE}$/m^2*	
Dwelling primary energy	62.23 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*25.4 kWh/m^2*	
Dwelling fabric energy efficiency	23.6 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	17.61	0.14 **(!)**
Party wall: Party Wall (1)	21.87	0 **(!)**
Party wall: Party Wall (2)	47.92	0 **(!)**
Exposed roof: Roof (1)	73.43	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	8.44	South West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E15: Flat roof with parapet	Calculated by person with suitable expertise	0.56	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.12	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.9 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 364 L07_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 364 L07_Copy	**Prop Type Ref**	Unit 364 L07
Property			

SAP Rating	77 C	**DER**	5.63	**TER**	11.96
Environmental	95 A	**% DER < TER**			52.93
CO_2 Emissions (t/year)	0.41	**DFEE**	23.62	**TFEE**	25.40
Compliance Check	See BREL	**% DFEE < TFEE**			7.02
% DPER < TPER	3.76	**DPER**	62.23	**TPER**	64.66

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		73.4300 (1b)	x	2.4000 (2b)	=	176.2320	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.4300						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.2320	(5)

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2. Ventilation rate

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	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			8.4400	1.2357	10.4297			(27)
External Wall 1	26.0500	8.4400	17.6100	0.1400	2.4654	14.0000	246.5400	(29a)
External Roof 1	73.4300		73.4300	0.1100	8.0773	9.0000	660.8700	(30)
Total net area of external elements Aum(A, m2)			99.4800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	20.9724			(33)
Party Wall 1			21.8700	0.0000	0.0000	20.0000	437.4000	(32)
Wall to corridor			47.9200	0.0000	0.0000	20.0000	958.4000	(32)
Party Floor 1			73.4300			80.0000	5874.4000	(32d)
Internal Wall 1			131.3800			9.0000	1182.4200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9360.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		127.4687 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.6400	0.0500	0.1820

E4 Jamb	18.5600	0.0500	0.9280		
E7 Party floor between dwellings (in blocks of flats)	10.9500	0.0700	0.7665		
E18 Party wall between dwellings	5.4000	0.0600	0.3240		
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.6000	0.0000	0.0000		
E15 Flat roof with parapet	9.6500	0.5600	5.4040		
P4 Party wall - Roof (insulation at ceiling level)	25.6000	0.1200	3.0720		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				10.6765	(36)
Point Thermal bridges			(36a) =	0.0000	
Total fabric heat loss			(33) + (36) + (36a) =	31.6489	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.7618	16.5928	16.4238	15.5787	15.4097	14.5646	14.5646	14.3956	14.9026	15.4097	15.7477	16.0857	(38)
Heat transfer coeff	48.4107	48.2417	48.0726	47.2275	47.0585	46.2134	46.2134	46.0444	46.5515	47.0585	47.3966	47.7346	(39)
Average = Sum(39)m / 12 =												47.1853	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6593	0.6570	0.6547	0.6432	0.6409	0.6294	0.6294	0.6271	0.6340	0.6409	0.6455	0.6501	(40)
HLP (average)												0.6426	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3264	(42)
Hot water usage for mixer showers	86.9363	85.6298	83.7260	80.0834	77.3953	74.3975	72.6935	74.5829	76.6541	79.8728	83.5936	86.6032	(42a)
Hot water usage for baths	27.3126	26.9070	26.3358	25.2826	24.4939	23.6195	23.1471	23.7143	24.3319	25.2677	26.3426	27.2203	(42b)
Hot water usage for other uses	38.4550	37.0567	35.6583	34.2599	32.8616	31.4632	31.4632	32.8616	34.2599	35.6583	37.0567	38.4550	(42c)
Average daily hot water use (litres/day)												140.4346	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	152.7039	149.5935	145.7201	139.6259	134.7508	129.4802	127.3039	131.1589	135.2459	140.7987	146.9928	152.2785	(44)
Energy conte	241.8457	213.0191	223.9663	191.1409	181.4004	159.2110	153.9630	162.4021	166.7718	191.0625	209.4182	238.4313	(45)
Energy content (annual)										Total = Sum(45)m =		2332.6323	
Distribution loss (46)m = 0.15 x (45)m	36.2769	31.9529	33.5949	28.6711	27.2101	23.8816	23.0945	24.3603	25.0158	28.6594	31.4127	35.7647	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	262.8265	231.9695	244.9471	211.4449	202.3812	179.5150	174.9438	183.3829	187.0758	212.0433	229.7222	259.4121	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	262.8265	231.9695	244.9471	211.4449	202.3812	179.5150	174.9438	183.3829	187.0758	212.0433	229.7222	259.4121	(64)
										Total per year (kWh/year) = Sum(64)m =		2579.6643	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	97.1983	85.9892	91.2534	79.7975	77.1003	69.1808	67.9773	70.7833	71.6948	80.3129	85.8748	96.0631	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	139.5862	139.5862	139.5862	139.5862	139.5862	139.5862	139.5862	139.5862	139.5862	139.5862	139.5862	139.5862	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.5060	22.6542	18.4237	13.9479	10.4262	8.8022	9.5111	12.3629	16.5935	21.0693	24.5909	26.2149	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	306.2187	309.3963	301.3889	284.3420	262.8234	242.5989	229.0878	225.9102	233.9176	250.9645	272.4831	292.7075	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.2851	51.2851	51.2851	51.2851	51.2851	51.2851	51.2851	51.2851	51.2851	51.2851	51.2851	51.2851	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-93.0575	-93.0575	-93.0575	-93.0575	-93.0575	-93.0575	-93.0575	-93.0575	-93.0575	-93.0575	-93.0575	-93.0575	(71)
Water heating gains (Table 5)	130.6429	127.9601	122.6525	110.8299	103.6294	96.0845	91.3674	95.1389	99.5761	107.9475	119.2705	129.1170	(72)
Total internal gains	560.1815	557.8244	540.2788	506.9336	474.6928	445.2995	427.7801	431.2258	447.9010	477.7950	514.1583	545.8533	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	8.4400	36.7938	0.6300	0.8270	0.7700	112.1235	(79)

Solar gains	112.1235	190.9879	261.3179	323.7856	362.6668	360.0442	347.1210	318.1139	282.9520	211.0823	134.2981	95.9544	(83)
Total gains	672.3050	748.8123	801.5967	830.7192	837.3596	805.3437	774.9011	749.3397	730.8531	688.8773	648.4565	641.8076	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	53.7073	53.8955	54.0850	55.0528	55.2505	56.2609	56.2609	56.4674	55.8523	55.2505	54.8565	54.4680	
alpha	4.5805	4.5930	4.6057	4.6702	4.6834	4.7507	4.7507	4.7645	4.7235	4.6834	4.6571	4.6312	
util living area	0.8874	0.8359	0.7599	0.6454	0.5104	0.3653	0.2621	0.2822	0.4344	0.6620	0.8297	0.9004	(86)
MIT	20.4088	20.5789	20.7542	20.9009	20.9712	20.9955	20.9993	20.9990	20.9895	20.9063	20.6613	20.3728	(87)
Th 2	20.3769	20.3790	20.3810	20.3913	20.3934	20.4037	20.4037	20.4057	20.3995	20.3934	20.3893	20.3851	(88)
util rest of house	0.8752	0.8201	0.7391	0.6192	0.4797	0.3318	0.2267	0.2459	0.3980	0.6315	0.8110	0.8894	(89)
MIT 2	19.6971	19.9036	20.1127	20.2894	20.3666	20.4002	20.4032	20.4051	20.3910	20.3002	20.0153	19.6602	(90)
Living area fraction									fLA = Living area / (4) =			0.4380	(91)
MIT	20.0088	20.1994	20.3937	20.5572	20.6314	20.6609	20.6643	20.6652	20.6531	20.5657	20.2982	19.9723	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0088	20.1994	20.3937	20.5572	20.6314	20.6609	20.6643	20.6652	20.6531	20.5657	20.2982	19.9723	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8674	0.8152	0.7396	0.6265	0.4918	0.3463	0.2422	0.2618	0.4134	0.6403	0.8081	0.8812	(94)
Useful gains	583.1643	610.4472	592.8398	520.4323	411.8332	278.8818	187.6545	196.1420	302.1705	441.1125	524.0250	565.5620	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	760.4737	738.0670	667.9061	550.5420	420.2973	280.0942	187.8240	196.3878	305.0569	468.9693	625.5504	752.8852	(97)
Space heating kWh	131.9181	85.7606	55.8493	21.6790	6.2973	0.0000	0.0000	0.0000	0.0000	20.7255	73.0983	139.3684	(98a)
Space heating requirement - total per year (kWh/year)												534.6965	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	131.9181	85.7606	55.8493	21.6790	6.2973	0.0000	0.0000	0.0000	0.0000	20.7255	73.0983	139.3684	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												534.6965	
Space heating per m2											(98c) / (4) =	7.2817	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	131.9181	85.7606	55.8493	21.6790	6.2973	0.0000	0.0000	0.0000	0.0000	20.7255	73.0983	139.3684	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	131.9181	85.7606	55.8493	21.6790	6.2973	0.0000	0.0000	0.0000	0.0000	20.7255	73.0983	139.3684	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	262.8265	231.9695	244.9471	211.4449	202.3812	179.5150	174.9438	183.3829	187.0758	212.0433	229.7222	259.4121	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	262.8265	231.9695	244.9471	211.4449	202.3812	179.5150	174.9438	183.3829	187.0758	212.0433	229.7222	259.4121	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.5493	12.2381	13.5493	13.1122	13.5493	13.1122	13.5493	13.5493	13.1122	13.5493	13.1122	13.5493	(231)
Lighting	22.3253	17.9102	16.1261	11.8147	9.1260	7.4560	8.3250	10.8212	14.0557	18.4418	20.8300	22.9458	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.7473	-26.6718	-43.3274	-54.3684	-63.5569	-60.9787	-60.0111	-54.1399	-44.1943	-32.4160	-19.2992	-14.1096	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.0894	-7.3343	-16.5995	-28.2258	-39.9897	-41.3251	-40.7378	-32.9700	-22.5052	-11.6409	-4.4176	-2.3585	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	534.6965	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2579.6643	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	159.5323	(230a)
Total electricity for the above, kWh/year	159.5323	(231)
Electricity for lighting (calculated in Appendix L)	180.1777	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-741.0144	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)

Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2713.0564	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	534.6965	16.4900	88.1715	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2579.6643	16.4900	425.3867	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	159.5323	16.4900	26.3069	(249)
Energy for lighting	180.1777	16.4900	29.7113	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-489.8206	16.4900	-80.7714	
PV Unit electricity exported	-251.1939	5.5900	-14.0417	
Total			-94.8131	(252)
Total energy cost			474.7631	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.4432	(257)
SAP value		76.6062	
SAP rating (Section 12)		77	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	534.6965	0.1576	84.2742	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2579.6643	0.1413	364.5165	(264)
Space and water heating			448.7907	(265)
Pumps, fans and electric keep-hot	159.5323	0.1387	22.1291	(267)
Energy for lighting	180.1777	0.1443	26.0052	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-489.8206	0.1324	-64.8472	
PV Unit electricity exported	-251.1939	0.1229	-30.8689	
Total			-95.7162	(269)
Total CO2, kg/year			401.2088	(272)
CO2 emissions per m2			5.4600	(273)
EI value			95.4604	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		73.4300 (1b)	x	2.4000 (2b)	=	176.2320	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.4300						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.2320	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			8.4400	1.2357	10.4297			(27)
External Wall 1	26.0500	8.4400	17.6100	0.1400	2.4654	14.0000	246.5400	(29a)
External Roof 1	73.4300		73.4300	0.1100	8.0773	9.0000	660.8700	(30)
Total net area of external elements Aum(A, m2)			99.4800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	20.9724			(33)
Party Wall 1			21.8700	0.0000	0.0000	20.0000	437.4000	(32)
Wall to corridor			47.9200	0.0000	0.0000	20.0000	958.4000	(32)
Party Floor 1			73.4300			80.0000	5874.4000	(32d)
Internal Wall 1			131.3800			9.0000	1182.4200	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9360.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 127.4687 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	3.6400	0.0500	0.1820
E4 Jamb	18.5600	0.0500	0.9280
E7 Party floor between dwellings (in blocks of flats)	10.9500	0.0700	0.7665
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.6000	0.0000	0.0000
E15 Flat roof with parapet	9.6500	0.5600	5.4040
P4 Party wall - Roof (insulation at ceiling level)	25.6000	0.1200	3.0720

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.6765 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 31.6489 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.9308	16.9308	16.5928	15.5787	15.4097	14.7336	14.3956	14.3956	15.0716	15.9167	16.2548	16.0857	(38)
Heat transfer coeff	48.5797	48.5797	48.2417	47.2275	47.0585	46.3825	46.0444	46.0444	46.7205	47.5656	47.9036	47.7346	(39)
Average = Sum(39)m / 12 =												47.3402	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6616	0.6616	0.6570	0.6432	0.6409	0.6317	0.6271	0.6271	0.6363	0.6478	0.6524	0.6501	(40)
HLP (average)												0.6447	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3264 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	86.9363	85.6298	83.7260	80.0834	77.3953	74.3975	72.6935	74.5829	76.6541	79.8728	83.5936	86.6032	(42a)
Hot water usage for baths	27.3126	26.9070	26.3358	25.2826	24.4939	23.6195	23.1471	23.7143	24.3319	25.2677	26.3426	27.2203	(42b)
Hot water usage for other uses	38.4550	37.0567	35.6583	34.2599	32.8616	31.4632	31.4632	32.8616	34.2599	35.6583	37.0567	38.4550	(42c)
Average daily hot water use (litres/day)												140.4346	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	152.7039	149.5935	145.7201	139.6259	134.7508	129.4802	127.3039	131.1589	135.2459	140.7987	146.9928	152.2785	(44)
Energy conte	241.8457	213.0191	223.9663	191.1409	181.4004	159.2110	153.9630	162.4021	166.7718	191.0625	209.4182	238.4313	(45)
Energy content (annual)										Total = Sum(45)m =		2332.6323	
Distribution loss (46)m = 0.15 x (45)m	36.2769	31.9529	33.5949	28.6711	27.2101	23.8816	23.0945	24.3603	25.0158	28.6594	31.4127	35.7647	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	262.8265	231.9695	244.9471	211.4449	202.3812	179.5150	174.9438	183.3829	187.0758	212.0433	229.7222	259.4121	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	262.8265	231.9695	244.9471	211.4449	202.3812	179.5150	174.9438	183.3829	187.0758	212.0433	229.7222	259.4121	(64)
									Total per year (kWh/year) = Sum(64)m =			2579.6643	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)

Heat gains from water heating, kWh/month

	97.1983	85.9892	91.2534	79.7975	77.1003	69.1808	67.9773	70.7833	71.6948	80.3129	85.8748	96.0631	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	139.5862	139.5862	139.5862	139.5862	139.5862	139.5862	139.5862	139.5862	139.5862	139.5862	139.5862	139.5862	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	25.5060	22.6542	18.4237	13.9479	10.4262	8.8022	9.5111	12.3629	16.5935	21.0693	24.5909	26.2149	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	306.2187	309.3963	301.3889	284.3420	262.8234	242.5989	229.0878	225.9102	233.9176	250.9645	272.4831	292.7075	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	51.2851	51.2851	51.2851	51.2851	51.2851	51.2851	51.2851	51.2851	51.2851	51.2851	51.2851	51.2851	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-93.0575	-93.0575	-93.0575	-93.0575	-93.0575	-93.0575	-93.0575	-93.0575	-93.0575	-93.0575	-93.0575	-93.0575	(71)

Water heating gains (Table 5)

	130.6429	127.9601	122.6525	110.8299	103.6294	96.0845	91.3674	95.1389	99.5761	107.9475	119.2705	129.1170	(72)

Total internal gains

	560.1815	557.8244	540.2788	506.9336	474.6928	445.2995	427.7801	431.2258	447.9010	477.7950	514.1583	545.8533	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	8.4400	33.4622	0.6300	0.8270	0.7700	101.9710	(79)

Solar gains	101.9710	185.3848	265.0887	345.5016	383.0724	369.6182	360.7760	321.5128	284.4645	203.6619	125.5205	89.2433	(83)
Total gains	662.1524	743.2092	805.3675	852.4353	857.7652	814.9177	788.5561	752.7386	732.3656	681.4570	639.6788	635.0966	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.5205	53.5205	53.8955	55.0528	55.2505	56.0559	56.4674	56.4674	55.6503	54.6615	54.2758	54.4680	
alpha	4.5680	4.5680	4.5930	4.6702	4.6834	4.7371	4.7645	4.7645	4.7100	4.6441	4.6184	4.6312	
util living area	0.8996	0.8544	0.7866	0.6726	0.5474	0.4386	0.3545	0.3769	0.5110	0.7137	0.8516	0.9113	(86)
MIT	20.3446	20.5084	20.6943	20.8728	20.9575	20.9878	20.9963	20.9951	20.9751	20.8568	20.5941	20.3085	(87)
Th 2	20.3749	20.3749	20.3790	20.3913	20.3934	20.4016	20.4057	20.4057	20.3975	20.3872	20.3831	20.3851	(88)
util rest of house	0.8886	0.8401	0.7678	0.6484	0.5185	0.4063	0.3205	0.3415	0.4763	0.6859	0.8348	0.9015	(89)
MIT 2	19.6165	19.8148	20.0401	20.2575	20.3522	20.3911	20.4029	20.4020	20.3753	20.2400	19.9299	19.5807	(90)
Living area fraction									fLA = Living area / (4) =			0.4380	(91)
MIT	19.9354	20.1186	20.3266	20.5269	20.6173	20.6524	20.6628	20.6617	20.6380	20.5102	20.2208	19.8994	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9354	20.1186	20.3266	20.5269	20.6173	20.6524	20.6628	20.6617	20.6380	20.5102	20.2208	19.8994	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8801	0.8338	0.7662	0.6539	0.5293	0.4199	0.3352	0.3568	0.4903	0.6916	0.8301	0.8928	(94)
Useful gains	582.7526	619.7113	617.0668	557.4357	453.9939	342.2126	264.3605	268.5894	359.0629	471.3220	530.9729	567.0263	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	778.9948	768.4619	710.4365	596.3393	466.6943	345.6621	265.3440	269.8993	366.1957	514.1915	652.4855	773.2738	(97)
Space heating kWh	146.0042	99.9604	69.4670	28.0106	9.4491	0.0000	0.0000	0.0000	0.0000	31.8949	87.4891	153.4481	(98a)
Space heating requirement - total per year (kWh/year)												625.7234	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	146.0042	99.9604	69.4670	28.0106	9.4491	0.0000	0.0000	0.0000	0.0000	31.8949	87.4891	153.4481	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												625.7234	
Space heating per m2										(98c) / (4) =		8.5214	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	146.0042	99.9604	69.4670	28.0106	9.4491	0.0000	0.0000	0.0000	0.0000	31.8949	87.4891	153.4481	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	146.0042	99.9604	69.4670	28.0106	9.4491	0.0000	0.0000	0.0000	0.0000	31.8949	87.4891	153.4481	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	262.8265	231.9695	244.9471	211.4449	202.3812	179.5150	174.9438	183.3829	187.0758	212.0433	229.7222	259.4121	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													

	262.8265	231.9695	244.9471	211.4449	202.3812	179.5150	174.9438	183.3829	187.0758	212.0433	229.7222	259.4121	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.5493	12.2381	13.5493	13.1122	13.5493	13.1122	13.5493	13.5493	13.1122	13.5493	13.1122	13.5493	(231)
Lighting	22.3253	17.9102	16.1261	11.8147	9.1260	7.4560	8.3250	10.8212	14.0557	18.4418	20.8300	22.9458	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.1743	-25.7137	-43.4833	-56.8477	-65.9251	-61.8676	-61.4047	-54.1564	-43.9022	-31.1570	-17.9697	-13.0441	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.6045	-6.7936	-16.4231	-30.2646	-42.5526	-42.4725	-42.5489	-32.9886	-22.2399	-10.7053	-3.8695	-2.0551	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	625.7234	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2579.6643	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	159.5323	(230a)
Total electricity for the above, kWh/year	159.5323	(231)
Electricity for lighting (calculated in Appendix L)	180.1777	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-746.1639	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2798.9338	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	625.7234	25.1600	157.4320	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2579.6643	25.1600	649.0436	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	159.5323	25.1600	40.1383	(249)
Energy for lighting	180.1777	25.1600	45.3327	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-490.6456	25.1600	-123.4464	
PV Unit electricity exported	-255.5183	5.8100	-14.8456	
Total			-138.2921	(252)
Total energy cost			753.6545	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	625.7234	0.1570	98.2342	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2579.6643	0.1413	364.5165	(264)
Space and water heating			462.7507	(265)
Pumps, fans and electric keep-hot	159.5323	0.1387	22.1291	(267)
Energy for lighting	180.1777	0.1443	26.0052	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-490.6456	0.1321	-64.8104	
PV Unit electricity exported	-255.5183	0.1223	-31.2621	
Total			-96.0726	(269)
Total CO2, kg/year			414.8124	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	625.7234	1.5812	989.3757	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2579.6643	1.5225	3927.5662	(278)
Space and water heating			4916.9419	(279)
Pumps, fans and electric keep-hot	159.5323	1.5128	241.3404	(281)
Energy for lighting	180.1777	1.5338	276.3626	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-490.6456	1.4881	-730.1091	
PV Unit electricity exported	-255.5183	0.4490	-114.7228	
Total			-844.8319	(283)
Total Primary energy kWh/year			4589.8130	(286)

SAP 10 EPC IMPROVEMENTS

Unit 364 L07_Copy

Current energy efficiency rating: C 77
Current environmental impact rating: A 95

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 77
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£892	£892	£0
Space heating	£198	£198	£0
Water heating	£649	£649	£0
Lighting	£45	£45	£0
Generated (PV)	-£138	-£138	£0
Total cost of fuels	£754	£754	£0
Total cost of uses	£754	£754	£0
Delivered energy	38 kWh/m²	38 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	63 kWh/m²	63 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	73.4300 (1b)	x	2.4000 (2b)	=	176.2320	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.4300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.2320	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			8.4400	1.2357	10.4297			(27)
External Wall 1	26.0500	8.4400	17.6100	0.1400	2.4654	14.0000	246.5400	(29a)
External Roof 1	73.4300		73.4300	0.1100	8.0773	9.0000	660.8700	(30)
Total net area of external elements Aum(A, m2)			99.4800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		20.9724			(33)
Party Wall 1			21.8700	0.0000	0.0000	20.0000	437.4000	(32)
Wall to corridor			47.9200	0.0000	0.0000	20.0000	958.4000	(32)
Party Floor 1			73.4300			80.0000	5874.4000	(32d)
Internal Wall 1			131.3800			9.0000	1182.4200	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9360.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 127.4687 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	3.6400	0.0500	0.1820
E4 Jamb	18.5600	0.0500	0.9280
E7 Party floor between dwellings (in blocks of flats)	10.9500	0.0700	0.7665
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.6000	0.0000	0.0000
E15 Flat roof with parapet	9.6500	0.5600	5.4040
P4 Party wall - Roof (insulation at ceiling level)	25.6000	0.1200	3.0720

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.6765 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 31.6489 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.7618	16.5928	16.4238	15.5787	15.4097	14.5646	14.5646	14.3956	14.9026	15.4097	15.7477	16.0857	(38)
Heat transfer coeff	48.4107	48.2417	48.0726	47.2275	47.0585	46.2134	46.2134	46.0444	46.5515	47.0585	47.3966	47.7346	(39)

Average = Sum(39)m / 12 = 47.1853

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6593	0.6570	0.6547	0.6432	0.6409	0.6294	0.6294	0.6271	0.6340	0.6409	0.6455	0.6501	(40)
HLP (average)												0.6426	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3264 (42)
Hot water usage for mixer showers

86.9363	85.6298	83.7260	80.0834	77.3953	74.3975	72.6935	74.5829	76.6541	79.8728	83.5936	86.6032	(42a)

Hot water usage for baths

27.3126	26.9070	26.3358	25.2826	24.4939	23.6195	23.1471	23.7143	24.3319	25.2677	26.3426	27.2203	(42b)

Hot water usage for other uses

38.4550	37.0567	35.6583	34.2599	32.8616	31.4632	31.4632	32.8616	34.2599	35.6583	37.0567	38.4550	(42c)

Average daily hot water use (litres/day) 140.4346 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	152.7039	149.5935	145.7201	139.6259	134.7508	129.4802	127.3039	131.1589	135.2459	140.7987	146.9928	152.2785	(44)
Energy conte	241.8457	213.0191	223.9663	191.1409	181.4004	159.2110	153.9630	162.4021	166.7718	191.0625	209.4182	238.4313	(45)

Energy content (annual) Total = Sum(45)m = 2332.6323
Distribution loss (46)m = 0.15 x (45)m

36.2769	31.9529	33.5949	28.6711	27.2101	23.8816	23.0945	24.3603	25.0158	28.6594	31.4127	35.7647	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

262.8265	231.9695	244.9471	211.4449	202.3812	179.5150	174.9438	183.3829	187.0758	212.0433	229.7222	259.4121	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h												
262.8265	231.9695	244.9471	211.4449	202.3812	179.5150	174.9438	183.3829	187.0758	212.0433	229.7222	259.4121	(64)

Total per year (kWh/year) = Sum(64)m = 2579.6643 (64)
Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month

97.1983	85.9892	91.2534	79.7975	77.1003	69.1808	67.9773	70.7833	71.6948	80.3129	85.8748	96.0631	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	139.5862	139.5862	139.5862	139.5862	139.5862	139.5862	139.5862	139.5862	139.5862	139.5862	139.5862	139.5862	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.5060	22.6542	18.4237	13.9479	10.4262	8.8022	9.5111	12.3629	16.5935	21.0693	24.5909	26.2149	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	306.2187	309.3963	301.3889	284.3420	262.8234	242.5989	229.0878	225.9102	233.9176	250.9645	272.4831	292.7075	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.2851	51.2851	51.2851	51.2851	51.2851	51.2851	51.2851	51.2851	51.2851	51.2851	51.2851	51.2851	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(70)
Losses e.g. evaporation (negative values) (Table 5)	-93.0575	-93.0575	-93.0575	-93.0575	-93.0575	-93.0575	-93.0575	-93.0575	-93.0575	-93.0575	-93.0575	-93.0575	(71)
Water heating gains (Table 5)	130.6429	127.9601	122.6525	110.8299	103.6294	96.0845	91.3674	95.1389	99.5761	107.9475	119.2705	129.1170	(72)

Total internal gains

	560.1815	557.8244	540.2788	506.9336	474.6928	445.2995	427.7801	431.2258	447.9010	477.7950	514.1583	545.8533	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	8.4400	36.7938	0.6300	0.8270	0.7700	112.1235	(79)

Solar gains	112.1235	190.9879	261.3179	323.7856	362.6668	360.0442	347.1210	318.1139	282.9520	211.0823	134.2981	95.9544	(83)
Total gains	672.3050	748.8123	801.5967	830.7192	837.3596	805.3437	774.9011	749.3397	730.8531	688.8773	648.4565	641.8076	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.7073	53.8955	54.0850	55.0528	55.2505	56.2609	56.2609	56.4674	55.8523	55.2505	54.8565	54.4680	
alpha	4.5805	4.5930	4.6057	4.6702	4.6834	4.7507	4.7507	4.7645	4.7235	4.6834	4.6571	4.6312	
util living area													
	0.8874	0.8359	0.7599	0.6454	0.5104	0.3653	0.2621	0.2822	0.4344	0.6620	0.8297	0.9004	(86)
MIT	20.4088	20.5789	20.7542	20.9009	20.9712	20.9955	20.9993	20.9990	20.9895	20.9063	20.6613	20.3728	(87)
Th 2	20.3769	20.3790	20.3810	20.3913	20.3934	20.4037	20.4037	20.4057	20.3995	20.3934	20.3893	20.3851	(88)
util rest of house													
	0.8752	0.8201	0.7391	0.6192	0.4797	0.3318	0.2267	0.2459	0.3980	0.6315	0.8110	0.8894	(89)
MIT 2	19.6971	19.9036	20.1127	20.2894	20.3666	20.4002	20.4032	20.4051	20.3910	20.3002	20.0153	19.6602	(90)
Living area fraction										fLA = Living area / (4) =		0.4380	(91)
MIT	20.0088	20.1994	20.3937	20.5572	20.6314	20.6609	20.6643	20.6652	20.6531	20.5657	20.2982	19.9723	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0088	20.1994	20.3937	20.5572	20.6314	20.6609	20.6643	20.6652	20.6531	20.5657	20.2982	19.9723	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8674	0.8152	0.7396	0.6265	0.4918	0.3463	0.2422	0.2618	0.4134	0.6403	0.8081	0.8812	(94)
Useful gains	583.1643	610.4472	592.8398	520.4323	411.8332	278.8818	187.6545	196.1420	302.1705	441.1125	524.0250	565.5620	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	760.4737	738.0670	667.9061	550.5420	420.2973	280.0942	187.8240	196.3878	305.0569	468.9693	625.5504	752.8852	(97)
Space heating kWh													
	131.9181	85.7606	55.8493	21.6790	6.2973	0.0000	0.0000	0.0000	0.0000	20.7255	73.0983	139.3684	(98a)
Space heating requirement - total per year (kWh/year)												534.6965	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	131.9181	85.7606	55.8493	21.6790	6.2973	0.0000	0.0000	0.0000	0.0000	20.7255	73.0983	139.3684	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												534.6965	
Space heating per m2											(98c) / (4) =	7.2817	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	131.9181	85.7606	55.8493	21.6790	6.2973	0.0000	0.0000	0.0000	0.0000	20.7255	73.0983	139.3684	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	131.9181	85.7606	55.8493	21.6790	6.2973	0.0000	0.0000	0.0000	0.0000	20.7255	73.0983	139.3684	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	262.8265	231.9695	244.9471	211.4449	202.3812	179.5150	174.9438	183.3829	187.0758	212.0433	229.7222	259.4121	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	262.8265	231.9695	244.9471	211.4449	202.3812	179.5150	174.9438	183.3829	187.0758	212.0433	229.7222	259.4121	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.5493	12.2381	13.5493	13.1122	13.5493	13.1122	13.5493	13.5493	13.1122	13.5493	13.1122	13.5493	(231)
Lighting	22.3253	17.9102	16.1261	11.8147	9.1260	7.4560	8.3250	10.8212	14.0557	18.4418	20.8300	22.9458	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.7473	-26.6718	-43.3274	-54.3684	-63.5569	-60.9787	-60.0111	-54.1399	-44.1943	-32.4160	-19.2992	-14.1096	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.0894	-7.3343	-16.5995	-28.2258	-39.9897	-41.3251	-40.7378	-32.9700	-22.5052	-11.6409	-4.4176	-2.3585	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	534.6965	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2579.6643	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	159.5323	(230a)
Total electricity for the above, kWh/year	159.5323	(231)
Electricity for lighting (calculated in Appendix L)	180.1777	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-741.0144	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2713.0564	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	534.6965	16.4900	88.1715	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2579.6643	16.4900	425.3867	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	159.5323	16.4900	26.3069	(249)
Energy for lighting	180.1777	16.4900	29.7113	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-489.8206	16.4900	-80.7714	
PV Unit electricity exported	-251.1939	5.5900	-14.0417	
Total			-94.8131	(252)
Total energy cost			474.7631	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.4432	(257)
SAP value		76.6062	
SAP rating (Section 12)		77	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	534.6965	0.1576	84.2742	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2579.6643	0.1413	364.5165	(264)
Space and water heating			448.7907	(265)
Pumps, fans and electric keep-hot	159.5323	0.1387	22.1291	(267)
Energy for lighting	180.1777	0.1443	26.0052	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-489.8206	0.1324	-64.8472	
PV Unit electricity exported	-251.1939	0.1229	-30.8689	
Total			-95.7162	(269)
Total CO2, kg/year			401.2088	(272)
CO2 emissions per m2			5.4600	(273)
EI value			95.4604	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		73.4300 (1b)	x	2.4000 (2b)	=	176.2320	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.4300						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		176.2320	(5)

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2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			8.4400	1.2357	10.4297			(27)
External Wall 1	26.0500	8.4400	17.6100	0.1400	2.4654	14.0000	246.5400	(29a)
External Roof 1	73.4300		73.4300	0.1100	8.0773	9.0000	660.8700	(30)
Total net area of external elements Aum(A, m2)			99.4800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		20.9724			(33)
Party Wall 1			21.8700	0.0000	0.0000	20.0000	437.4000	(32)
Wall to corridor			47.9200	0.0000	0.0000	20.0000	958.4000	(32)
Party Floor 1			73.4300			80.0000	5874.4000	(32d)
Internal Wall 1			131.3800			9.0000	1182.4200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9360.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		127.4687 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.6400	0.0500	0.1820
E4 Jamb	18.5600	0.0500	0.9280
E7 Party floor between dwellings (in blocks of flats)	10.9500	0.0700	0.7665
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.6000	0.0000	0.0000
E15 Flat roof with parapet	9.6500	0.5600	5.4040
P4 Party wall - Roof (insulation at ceiling level)	25.6000	0.1200	3.0720

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.6765 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	31.6489 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.9308	16.9308	16.5928	15.5787	15.4097	14.7336	14.3956	14.3956	15.0716	15.9167	16.2548	16.0857	(38)
Heat transfer coeff	48.5797	48.5797	48.2417	47.2275	47.0585	46.3825	46.0444	46.0444	46.7205	47.5656	47.9036	47.7346	(39)
Average = Sum(39)m / 12 =												47.3402	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6616	0.6616	0.6570	0.6432	0.6409	0.6317	0.6271	0.6271	0.6363	0.6478	0.6524	0.6501	(40)
HLP (average)												0.6447	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3264	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
86.9363	85.6298	83.7260	80.0834	77.3953	74.3975	72.6935	74.5829	76.6541	79.8728	83.5936	86.6032	(42a)

Hot water usage for baths

27.3126	26.9070	26.3358	25.2826	24.4939	23.6195	23.1471	23.7143	24.3319	25.2677	26.3426	27.2203	(42b)

Hot water usage for other uses

38.4550	37.0567	35.6583	34.2599	32.8616	31.4632	31.4632	32.8616	34.2599	35.6583	37.0567	38.4550	(42c)

Average daily hot water use (litres/day)	140.4346	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	152.7039	149.5935	145.7201	139.6259	134.7508	129.4802	127.3039	131.1589	135.2459	140.7987	146.9928	152.2785	(44)
Energy conte	241.8457	213.0191	223.9663	191.1409	181.4004	159.2110	153.9630	162.4021	166.7718	191.0625	209.4182	238.4313	(45)
Energy content (annual)										Total = Sum(45)m =		2332.6323	
Distribution loss (46)m = 0.15 x (45)m													
	36.2769	31.9529	33.5949	28.6711	27.2101	23.8816	23.0945	24.3603	25.0158	28.6594	31.4127	35.7647	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

Total storage loss

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	262.8265	231.9695	244.9471	211.4449	202.3812	179.5150	174.9438	183.3829	187.0758	212.0433	229.7222	259.4121	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

	262.8265	231.9695	244.9471	211.4449	202.3812	179.5150	174.9438	183.3829	187.0758	212.0433	229.7222	259.4121	(64)

Total per year (kWh/year) = Sum(64)m = 2579.6643 (64)

Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

	97.1983	85.9892	91.2534	79.7975	77.1003	69.1808	67.9773	70.7833	71.6948	80.3129	85.8748	96.0631	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	139.5862	139.5862	139.5862	139.5862	139.5862	139.5862	139.5862	139.5862	139.5862	139.5862	139.5862	139.5862	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	25.5060	22.6542	18.4237	13.9479	10.4262	8.8022	9.5111	12.3629	16.5935	21.0693	24.5909	26.2149	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	306.2187	309.3963	301.3889	284.3420	262.8234	242.5989	229.0878	225.9102	233.9176	250.9645	272.4831	292.7075	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	51.2851	51.2851	51.2851	51.2851	51.2851	51.2851	51.2851	51.2851	51.2851	51.2851	51.2851	51.2851	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-93.0575	-93.0575	-93.0575	-93.0575	-93.0575	-93.0575	-93.0575	-93.0575	-93.0575	-93.0575	-93.0575	-93.0575	(71)

Water heating gains (Table 5)

	130.6429	127.9601	122.6525	110.8299	103.6294	96.0845	91.3674	95.1389	99.5761	107.9475	119.2705	129.1170	(72)

Total internal gains

	560.1815	557.8244	540.2788	506.9336	474.6928	445.2995	427.7801	431.2258	447.9010	477.7950	514.1583	545.8533	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	8.4400	33.4622	0.6300	0.8270	0.7700	101.9710	(79)

Solar gains	101.9710	185.3848	265.0887	345.5016	383.0724	369.6182	360.7760	321.5128	284.4645	203.6619	125.5205	89.2433	(83)
Total gains	662.1524	743.2092	805.3675	852.4353	857.7652	814.9177	788.5561	752.7386	732.3656	681.4570	639.6788	635.0966	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.5205	53.5205	53.8955	55.0528	55.2505	56.0559	56.4674	56.4674	55.6503	54.6615	54.2758	54.4680	
alpha	4.5680	4.5680	4.5930	4.6702	4.6834	4.7371	4.7645	4.7645	4.7100	4.6441	4.6184	4.6312	
util living area													
	0.8996	0.8544	0.7866	0.6726	0.5474	0.4386	0.3545	0.3769	0.5110	0.7137	0.8516	0.9113	(86)
MIT	20.3446	20.5084	20.6943	20.8728	20.9575	20.9878	20.9963	20.9951	20.9751	20.8568	20.5941	20.3085	(87)
Th 2	20.3749	20.3749	20.3790	20.3913	20.3934	20.4016	20.4057	20.4057	20.3975	20.3872	20.3831	20.3851	(88)
util rest of house													
	0.8886	0.8401	0.7678	0.6484	0.5185	0.4063	0.3205	0.3415	0.4763	0.6859	0.8348	0.9015	(89)
MIT 2	19.6165	19.8148	20.0401	20.2575	20.3522	20.3911	20.4029	20.4020	20.3753	20.2400	19.9299	19.5807	(90)
Living area fraction									fLA = Living area / (4) =			0.4380	(91)
MIT	19.9354	20.1186	20.3266	20.5269	20.6173	20.6524	20.6628	20.6617	20.6380	20.5102	20.2208	19.8994	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9354	20.1186	20.3266	20.5269	20.6173	20.6524	20.6628	20.6617	20.6380	20.5102	20.2208	19.8994	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8801	0.8338	0.7662	0.6539	0.5293	0.4199	0.3352	0.3568	0.4903	0.6916	0.8301	0.8928	(94)
Useful gains	582.7526	619.7113	617.0668	557.4357	453.9939	342.2126	264.3605	268.5894	359.0629	471.3220	530.9729	567.0263	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	778.9948	768.4619	710.4365	596.3393	466.6943	345.6621	265.3440	269.8993	366.1957	514.1915	652.4855	773.2738	(97)
Space heating kWh													
	146.0042	99.9604	69.4670	28.0106	9.4491	0.0000	0.0000	0.0000	0.0000	31.8949	87.4891	153.4481	(98a)
Space heating requirement - total per year (kWh/year)												625.7234	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	146.0042	99.9604	69.4670	28.0106	9.4491	0.0000	0.0000	0.0000	0.0000	31.8949	87.4891	153.4481	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												625.7234	
Space heating per m2											(98c) / (4) =	8.5214	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	146.0042	99.9604	69.4670	28.0106	9.4491	0.0000	0.0000	0.0000	0.0000	31.8949	87.4891	153.4481	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	146.0042	99.9604	69.4670	28.0106	9.4491	0.0000	0.0000	0.0000	0.0000	31.8949	87.4891	153.4481	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	262.8265	231.9695	244.9471	211.4449	202.3812	179.5150	174.9438	183.3829	187.0758	212.0433	229.7222	259.4121	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	262.8265	231.9695	244.9471	211.4449	202.3812	179.5150	174.9438	183.3829	187.0758	212.0433	229.7222	259.4121	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.5493	12.2381	13.5493	13.1122	13.5493	13.1122	13.5493	13.5493	13.1122	13.5493	13.1122	13.5493	(231)
Lighting	22.3253	17.9102	16.1261	11.8147	9.1260	7.4560	8.3250	10.8212	14.0557	18.4418	20.8300	22.9458	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.1743	-25.7137	-43.4833	-56.8477	-65.9251	-61.8676	-61.4047	-54.1564	-43.9022	-31.1570	-17.9697	-13.0441	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.6045	-6.7936	-16.4231	-30.2646	-42.5526	-42.4725	-42.5489	-32.9886	-22.2399	-10.7053	-3.8695	-2.0551	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1	625.7234	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2579.6643	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	159.5323	(230a)
Total electricity for the above, kWh/year	159.5323	(231)
Electricity for lighting (calculated in Appendix L)	180.1777	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-746.1639	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2798.9338	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	625.7234	25.1600	157.4320	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2579.6643	25.1600	649.0436	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	159.5323	25.1600	40.1383	(249)
Energy for lighting	180.1777	25.1600	45.3327	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-490.6456	25.1600	-123.4464	
PV Unit electricity exported	-255.5183	5.8100	-14.8456	
Total			-138.2921	(252)
Total energy cost			753.6545	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	625.7234	0.1570	98.2342	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2579.6643	0.1413	364.5165	(264)
Space and water heating			462.7507	(265)
Pumps, fans and electric keep-hot	159.5323	0.1387	22.1291	(267)
Energy for lighting	180.1777	0.1443	26.0052	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-490.6456	0.1321	-64.8104	
PV Unit electricity exported	-255.5183	0.1223	-31.2621	
Total			-96.0726	(269)
Total CO2, kg/year			414.8124	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	625.7234	1.5812	989.3757	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2579.6643	1.5225	3927.5662	(278)
Space and water heating			4916.9419	(279)
Pumps, fans and electric keep-hot	159.5323	1.5128	241.3404	(281)
Energy for lighting	180.1777	1.5338	276.3626	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-490.6456	1.4881	-730.1091	
PV Unit electricity exported	-255.5183	0.4490	-114.7228	
Total			-844.8319	(283)
Total Primary energy kWh/year			4589.8130	(286)

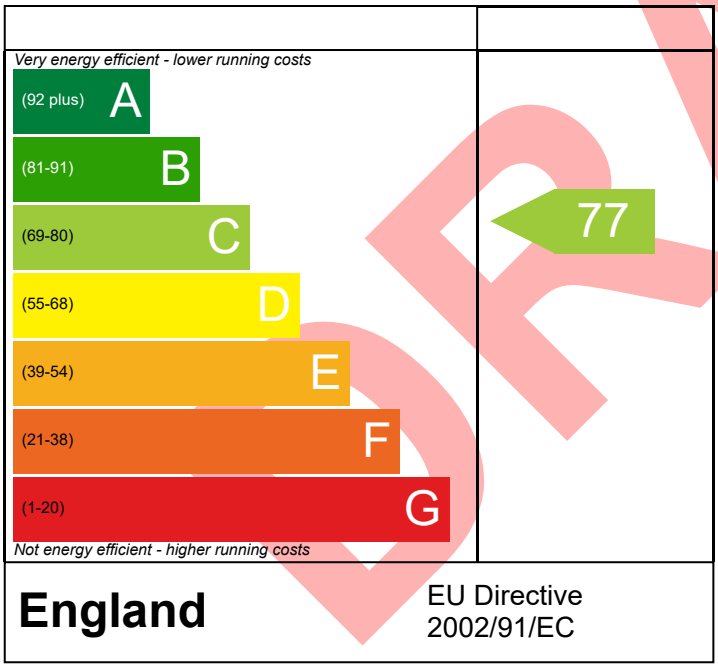
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	73.43 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

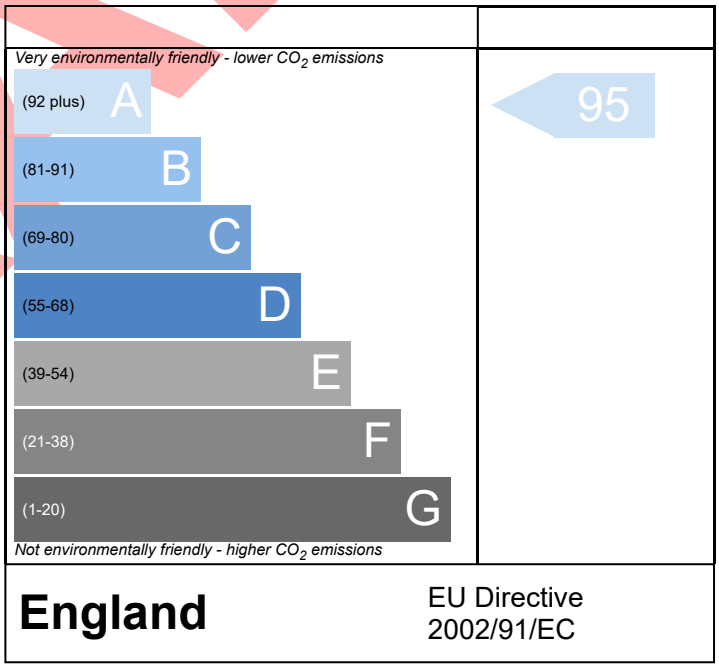
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:58

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	71 m^2
Site Reference	Unit 365 L07_Copy	Plot Reference	Unit 365 L07_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*9.51 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	4.43 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*51.39 kWh$_{PE}$/m^2*	
Dwelling primary energy	50.5 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*14.0 kWh/m^2*	
Dwelling fabric energy efficiency	12.9 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	11	0.14 **(!)**
Party wall: Party Wall (1)	52.62	0 **(!)**
Party wall: Party Wall (2)	15.55	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	11.81	South West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.92 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 365 L07_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 365 L07_Copy	**Prop Type Ref**	Unit 365 L07
Property			

SAP Rating	81 B	**DER**	4.43	**TER**	9.51
Environmental	96 A	**% DER < TER**			53.42
CO_2 Emissions (t/year)	0.31	**DFEE**	12.95	**TFEE**	14.02
Compliance Check	See BREL	**% DFEE < TFEE**			7.68
% DPER < TPER	1.73	**DPER**	50.50	**TPER**	51.39

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			136.8900			9.0000	1232.0100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14106.2100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		198.7350 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545

E4 Jamb	13.9200	0.0500	0.6960	
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.8660 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.2026	16.0392	15.8758	15.0589	14.8955	14.0786	14.0786	13.9153	14.4054	14.8955	15.2223	15.5490	(38)
Heat transfer coeff	34.2027	34.0393	33.8759	33.0590	32.8956	32.0787	32.0787	31.9154	32.4055	32.8956	33.2224	33.5491	(39)

Average = Sum(39)m / 12 = 33.0182

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4819	0.4796	0.4773	0.4658	0.4634	0.4519	0.4519	0.4496	0.4565	0.4634	0.4681	0.4727	(40)
HLP (average)												0.4652	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2697 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day) 138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)

Energy content (annual) Total = Sum(45)m = 2297.5146

Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)

Total per year (kWh/year) = Sum(64)m = 2544.5466 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	11.8100	36.7938	0.6300	0.8270	0.7700	156.8932	(79)

Solar gains	156.8932	267.2472	365.6593	453.0696	507.4757	503.8059	485.7227	445.1333	395.9317	295.3651	187.9219	134.2679	(83)
Total gains	703.2397	811.4507	893.0014	948.1177	971.2994	939.0493	903.8213	866.4472	833.2498	761.5780	689.4197	666.6128	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.5640	115.1138	115.6690	118.5272	119.1159	122.1492	122.1492	122.7745	120.9175	119.1159	117.9443	116.7956	
alpha	8.6376	8.6743	8.7113	8.9018	8.9411	9.1433	9.1433	9.1850	9.0612	8.9411	8.8630	8.7864	
util living area													
	0.7830	0.6679	0.5487	0.4218	0.3150	0.2186	0.1562	0.1694	0.2683	0.4490	0.6634	0.8084	(86)
MIT	20.9566	20.9872	20.9974	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9997	20.9906	20.9478	(87)
Th 2	20.5375	20.5396	20.5417	20.5523	20.5544	20.5651	20.5651	20.5672	20.5608	20.5544	20.5502	20.5460	(88)
util rest of house													
	0.7656	0.6501	0.5316	0.4062	0.2999	0.2038	0.1407	0.1535	0.2513	0.4298	0.6432	0.7918	(89)
MIT 2	20.4917	20.5266	20.5392	20.5521	20.5544	20.5651	20.5651	20.5672	20.5608	20.5542	20.5409	20.4903	(90)
Living area fraction										fLA = Living area / (4) =		0.4060	(91)
MIT	20.6805	20.7136	20.7253	20.7339	20.7353	20.7417	20.7417	20.7429	20.7391	20.7351	20.7235	20.6760	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6805	20.7136	20.7253	20.7339	20.7353	20.7417	20.7417	20.7429	20.7391	20.7351	20.7235	20.6760	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7711	0.6569	0.5385	0.4125	0.3060	0.2098	0.1470	0.1600	0.2582	0.4376	0.6510	0.7967	(94)
Useful gains	542.2498	533.0331	480.8626	391.1295	297.2181	197.0170	132.8596	138.6063	215.1439	333.2833	448.8144	531.0779	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	560.2549	538.2843	481.8939	391.2164	297.2233	197.0171	132.8596	138.6064	215.1447	333.3996	452.6050	552.7564	(97)
Space heating kWh													
	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(98a)
Space heating requirement - total per year (kWh/year)												36.7029	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												36.7029	
Space heating per m2											(98c) / (4) =	0.5171	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)
Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.7495	-26.5603	-43.1928	-54.4883	-64.0200	-61.6099	-60.6290	-54.7463	-44.7493	-32.6607	-19.3354	-14.1254	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.5280	-8.2015	-18.0659	-29.9413	-41.8277	-42.9674	-42.3587	-34.2994	-23.4325	-12.3753	-4.9084	-2.7087	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	36.7029	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2544.5466	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	154.2094	(230a)
Total electricity for the above, kWh/year	154.2094	(231)
Electricity for lighting (calculated in Appendix L)	163.7369	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-757.4814	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2141.7144	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	36.7029	16.4900	6.0523	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	16.4900	419.5957	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	16.4900	25.4291	(249)
Energy for lighting	163.7369	16.4900	27.0002	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-492.8668	16.4900	-81.2737	
PV Unit electricity exported	-264.6146	5.5900	-14.7920	
Total			-96.0657	(252)
Total energy cost			382.0117	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1858	(257)
SAP value		80.7789	
SAP rating (Section 12)		81	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	36.7029	0.1615	5.9279	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			365.4724	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-492.8668	0.1323	-65.2087	
PV Unit electricity exported	-264.6146	0.1235	-32.6780	
Total			-97.8867	(269)
Total CO2, kg/year			312.6088	(272)
CO2 emissions per m2			4.4000	(273)
EI value			96.3882	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			136.8900			9.0000	1232.0100	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14106.2100 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 198.7350 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.8660 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3659	16.3659	16.0392	15.0589	14.8955	14.2420	13.9153	13.9153	14.5688	15.3857	15.7124	15.5490	(38)
Heat transfer coeff	34.3660	34.3660	34.0393	33.0590	32.8956	32.2421	31.9154	31.9154	32.5689	33.3858	33.7125	33.5491	(39)

Average = Sum(39)m / 12 = 33.1679

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4842	0.4842	0.4796	0.4658	0.4634	0.4542	0.4496	0.4496	0.4588	0.4704	0.4750	0.4727	(40)
HLP (average)												0.4673	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2697 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day) 138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:

Store volume 143.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)

Temperature factor from Table 2b 0.6000 (49)

Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
										Total per year (kWh/year) = Sum(64)m =		2544.5466	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)													
	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains													
	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	11.8100	33.4622	0.6300	0.8270	0.7700	142.6869	(79)

Solar gains	142.6869	259.4069	370.9357	483.4567	536.0291	517.2027	504.8299	449.8893	398.0481	284.9819	175.6394	124.8772	(83)
Total gains	689.0334	803.6104	898.2779	978.5047	999.8527	952.4462	922.9286	871.2033	835.3662	751.1948	677.1372	657.2222	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.0193	114.0193	115.1138	118.5272	119.1159	121.5302	122.7745	122.7745	120.3109	117.3671	116.2296	116.7956	
alpha	8.6013	8.6013	8.6743	8.9018	8.9411	9.1020	9.1850	9.1850	9.0207	8.8245	8.7486	8.7864	
util living area													
	0.8121	0.7024	0.5813	0.4424	0.3389	0.2640	0.2109	0.2271	0.3197	0.5016	0.7054	0.8339	(86)
MIT	20.9408	20.9801	20.9957	20.9996	21.0000	21.0000	21.0000	21.0000	21.0000	20.9991	20.9836	20.9316	(87)
Th 2	20.5354	20.5354	20.5396	20.5523	20.5544	20.5630	20.5672	20.5672	20.5587	20.5481	20.5438	20.5460	(88)
util rest of house													
	0.7957	0.6848	0.5643	0.4273	0.3242	0.2492	0.1960	0.2113	0.3025	0.4817	0.6853	0.8185	(89)
MIT 2	20.4720	20.5147	20.5353	20.5520	20.5544	20.5630	20.5672	20.5672	20.5587	20.5473	20.5274	20.4721	(90)
Living area fraction										fLA = Living area / (4) =		0.4060	(91)
MIT	20.6623	20.7037	20.7222	20.7337	20.7353	20.7404	20.7429	20.7429	20.7379	20.7307	20.7126	20.6587	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6623	20.7037	20.7222	20.7337	20.7353	20.7404	20.7429	20.7429	20.7379	20.7307	20.7126	20.6587	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8002	0.6912	0.5711	0.4334	0.3302	0.2553	0.2021	0.2177	0.3095	0.4898	0.6928	0.8224	(94)
Useful gains	551.3951	555.4826	512.9858	424.1297	330.1075	243.1179	186.4793	189.6708	258.5229	367.9207	469.1053	540.4930	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	576.0546	563.7301	514.7494	424.2710	330.1185	243.1186	186.4794	189.6709	258.5275	368.2690	475.7715	568.9488	(97)
Space heating kWh													
	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711	(98a)
Space heating requirement - total per year (kWh/year)												51.5410	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												51.5410	
Space heating per m2											(98c) / (4) =	0.7261	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)

Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-15.1816	-25.5601	-43.1889	-56.7799	-66.2625	-62.5005	-62.0252	-54.7629	-44.4553	-31.2938	-17.9805	-13.0606 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.9923	-7.6695	-18.0487	-32.2682	-44.6258	-44.1582	-44.2385	-34.3187	-23.1566	-11.4989	-4.3440	-2.3741 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	51.5410 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2544.5466 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	154.2094 (230a)
Total electricity for the above, kWh/year	154.2094 (231)
Electricity for lighting (calculated in Appendix L)	163.7369 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-762.7453 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2151.2886 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	51.5410	25.1600	12.9677	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	25.1600	640.2079	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	25.1600	38.7991	(249)
Energy for lighting	163.7369	25.1600	41.1962	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.0518	25.1600	-124.0518	
PV Unit electricity exported	-269.6935	5.8100	-15.6692	
Total			-139.7210	(252)
Total energy cost			593.4499	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	51.5410	0.1611	8.3045	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			367.8491	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.0518	0.1320	-65.0800	
PV Unit electricity exported	-269.6935	0.1230	-33.1742	
Total			-98.2543	(269)
Total CO2, kg/year			314.6179	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	51.5410	1.5962	82.2716	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	1.5225	3874.0629	(278)
Space and water heating			3956.3345	(279)
Pumps, fans and electric keep-hot	154.2094	1.5128	233.2880	(281)
Energy for lighting	163.7369	1.5338	251.1452	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.0518	1.4877	-733.5071	
PV Unit electricity exported	-269.6935	0.4514	-121.7494	
Total			-855.2565	(283)
Total Primary energy kWh/year			3585.5112	(286)

SAP 10 EPC IMPROVEMENTS

Unit 365 L07_Copy

Current energy efficiency rating: B 81
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: B 81
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£733	£733	£0
Space heating	£52	£52	£0
Water heating	£640	£640	£0
Lighting	£41	£41	£0
Generated (PV)	-£140	-£140	£0
Total cost of fuels	£593	£593	£0
Total cost of uses	£593	£593	£0
Delivered energy	30 kWh/m²	30 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	4 kg/m²	4 kg/m²	0 kg/m²
Primary energy	51 kWh/m²	51 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			136.8900			9.0000	1232.0100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14106.2100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		198.7350 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.8660 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.2026	16.0392	15.8758	15.0589	14.8955	14.0786	14.0786	13.9153	14.4054	14.8955	15.2223	15.5490	(38)
Heat transfer coeff	34.2027	34.0393	33.8759	33.0590	32.8956	32.0787	32.0787	31.9154	32.4055	32.8956	33.2224	33.5491	(39)
Average = Sum(39)m / 12 =												33.0182	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4819	0.4796	0.4773	0.4658	0.4634	0.4519	0.4519	0.4496	0.4565	0.4634	0.4681	0.4727	(40)
HLP (average)												0.4652	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.2697 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)

Hot water usage for baths

26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)

Hot water usage for other uses

37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day)		138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
									Total per year (kWh/year) = Sum(64)m =		2544.5466	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest			11.8100	36.7938	0.6300	0.8270	0.7700	156.8932	(79)
Solar gains	156.8932	267.2472	365.6593	453.0696	507.4757	503.8059	485.7227	445.1333	395.9317	295.3651	187.9219	134.2679	(83)
Total gains	703.2397	811.4507	893.0014	948.1177	971.2994	939.0493	903.8213	866.4472	833.2498	761.5780	689.4197	666.6128	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.5640	115.1138	115.6690	118.5272	119.1159	122.1492	122.1492	122.7745	120.9175	119.1159	117.9443	116.7956	
alpha	8.6376	8.6743	8.7113	8.9018	8.9411	9.1433	9.1433	9.1850	9.0612	8.9411	8.8630	8.7864	
util living area	0.7830	0.6679	0.5487	0.4218	0.3150	0.2186	0.1562	0.1694	0.2683	0.4490	0.6634	0.8084	(86)
MIT	20.9566	20.9872	20.9974	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9997	20.9906	20.9478	(87)
Th 2	20.5375	20.5396	20.5417	20.5523	20.5544	20.5651	20.5651	20.5672	20.5608	20.5544	20.5502	20.5460	(88)
util rest of house	0.7656	0.6501	0.5316	0.4062	0.2999	0.2038	0.1407	0.1535	0.2513	0.4298	0.6432	0.7918	(89)
MIT 2	20.4917	20.5266	20.5392	20.5521	20.5544	20.5651	20.5651	20.5672	20.5608	20.5542	20.5409	20.4903	(90)
Living area fraction									fLA = Living area / (4) =			0.4060	(91)
MIT	20.6805	20.7136	20.7253	20.7339	20.7353	20.7417	20.7417	20.7429	20.7391	20.7351	20.7235	20.6760	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6805	20.7136	20.7253	20.7339	20.7353	20.7417	20.7417	20.7429	20.7391	20.7351	20.7235	20.6760	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7711	0.6569	0.5385	0.4125	0.3060	0.2098	0.1470	0.1600	0.2582	0.4376	0.6510	0.7967	(94)
Useful gains	542.2498	533.0331	480.8626	391.1295	297.2181	197.0170	132.8596	138.6063	215.1439	333.2833	448.8144	531.0779	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	560.2549	538.2843	481.8939	391.2164	297.2233	197.0171	132.8596	138.6064	215.1447	333.3996	452.6050	552.7564	(97)
Space heating kWh	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(98a)
Space heating requirement - total per year (kWh/year)												36.7029	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												36.7029	
Space heating per m2										(98c) / (4) =		0.5171	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)
Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.7495	-26.5603	-43.1928	-54.4883	-64.0200	-61.6099	-60.6290	-54.7463	-44.7493	-32.6607	-19.3354	-14.1254	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.5280	-8.2015	-18.0659	-29.9413	-41.8277	-42.9674	-42.3587	-34.2994	-23.4325	-12.3753	-4.9084	-2.7087	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												36.7029	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2544.5466	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	154.2094	(230a)
Total electricity for the above, kWh/year	154.2094	(231)
Electricity for lighting (calculated in Appendix L)	163.7369	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-757.4814	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2141.7144	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	36.7029	16.4900	6.0523	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	16.4900	419.5957	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	16.4900	25.4291	(249)
Energy for lighting	163.7369	16.4900	27.0002	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-492.8668	16.4900	-81.2737	
PV Unit electricity exported	-264.6146	5.5900	-14.7920	
Total			-96.0657	(252)
Total energy cost			382.0117	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.1858	(257)
SAP value	80.7789	
SAP rating (Section 12)	81	(258)
SAP band	B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	36.7029	0.1615	5.9279	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			365.4724	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-492.8668	0.1323	-65.2087	
PV Unit electricity exported	-264.6146	0.1235	-32.6780	
Total			-97.8867	(269)
Total CO2, kg/year			312.6088	(272)
CO2 emissions per m2			4.4000	(273)
EI value			96.3882	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 = 0.0000	(6a)
Number of open flues	0 * 20 = 0.0000	(6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			136.8900			9.0000	1232.0100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 14106.2100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.7350 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	1.8660 (36)
Point Thermal bridges (36a) =	0.0000
Total fabric heat loss (33) + (36) + (36a) =	18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3659	16.3659	16.0392	15.0589	14.8955	14.2420	13.9153	13.9153	14.5688	15.3857	15.7124	15.5490	(38)
Heat transfer coeff	34.3660	34.3660	34.0393	33.0590	32.8956	32.2421	31.9154	31.9154	32.5689	33.3858	33.7125	33.5491	(39)
Average = Sum(39)m / 12 =												33.1679	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4842	0.4842	0.4796	0.4658	0.4634	0.4542	0.4496	0.4496	0.4588	0.4704	0.4750	0.4727	(40)
HLP (average)												0.4673	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2697 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)
Average daily hot water use (litres/day)												138.3203	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
									Total per year (kWh/year) = Sum(64)m =			2544.5466	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	11.8100	33.4622	0.6300	0.8270	0.7700	142.6869	(79)

Solar gains	142.6869	259.4069	370.9357	483.4567	536.0291	517.2027	504.8299	449.8893	398.0481	284.9819	175.6394	124.8772	(83)
Total gains	689.0334	803.6104	898.2779	978.5047	999.8527	952.4462	922.9286	871.2033	835.3662	751.1948	677.1372	657.2222	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.0193	114.0193	115.1138	118.5272	119.1159	121.5302	122.7745	122.7745	120.3109	117.3671	116.2296	116.7956	
alpha	8.6013	8.6013	8.6743	8.9018	8.9411	9.1020	9.1850	9.1850	9.0207	8.8245	8.7486	8.7864	
util living area	0.8121	0.7024	0.5813	0.4424	0.3389	0.2640	0.2109	0.2271	0.3197	0.5016	0.7054	0.8339	(86)
MIT	20.9408	20.9801	20.9957	20.9996	21.0000	21.0000	21.0000	21.0000	21.0000	20.9991	20.9836	20.9316	(87)
Th 2	20.5354	20.5354	20.5396	20.5523	20.5544	20.5630	20.5672	20.5672	20.5587	20.5481	20.5438	20.5460	(88)
util rest of house	0.7957	0.6848	0.5643	0.4273	0.3242	0.2492	0.1960	0.2113	0.3025	0.4817	0.6853	0.8185	(89)
MIT 2	20.4720	20.5147	20.5353	20.5520	20.5544	20.5630	20.5672	20.5672	20.5587	20.5473	20.5274	20.4721	(90)
Living area fraction									fLA = Living area / (4) =			0.4060	(91)
MIT	20.6623	20.7037	20.7222	20.7337	20.7353	20.7404	20.7429	20.7429	20.7379	20.7307	20.7126	20.6587	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6623	20.7037	20.7222	20.7337	20.7353	20.7404	20.7429	20.7429	20.7379	20.7307	20.7126	20.6587	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8002	0.6912	0.5711	0.4334	0.3302	0.2553	0.2021	0.2177	0.3095	0.4898	0.6928	0.8224	(94)
Useful gains	551.3951	555.4826	512.9858	424.1297	330.1075	243.1179	186.4793	189.6708	258.5229	367.9207	469.1053	540.4930	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	576.0546	563.7301	514.7494	424.2710	330.1185	243.1186	186.4794	189.6709	258.5275	368.2690	475.7715	568.9488	(97)
Space heating kWh	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711	(98a)
Space heating requirement - total per year (kWh/year)												51.5410	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												51.5410	
Space heating per m2											(98c) / (4) =	0.7261	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													

	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972 (231)
Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-15.1816	-25.5601	-43.1889	-56.7799	-66.2625	-62.5005	-62.0252	-54.7629	-44.4553	-31.2938	-17.9805	-13.0606 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.9923	-7.6695	-18.0487	-32.2682	-44.6258	-44.1582	-44.2385	-34.3187	-23.1566	-11.4989	-4.3440	-2.3741 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	51.5410 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2544.5466 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	154.2094 (230a)
Total electricity for the above, kWh/year	154.2094 (231)
Electricity for lighting (calculated in Appendix L)	163.7369 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-762.7453 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2151.2886 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	51.5410	25.1600	12.9677	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	25.1600	640.2079	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	25.1600	38.7991	(249)
Energy for lighting	163.7369	25.1600	41.1962	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.0518	25.1600	-124.0518	
PV Unit electricity exported	-269.6935	5.8100	-15.6692	
Total			-139.7210	(252)
Total energy cost			593.4499	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	51.5410	0.1611	8.3045	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			367.8491	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.0518	0.1320	-65.0800	
PV Unit electricity exported	-269.6935	0.1230	-33.1742	
Total			-98.2543	(269)
Total CO2, kg/year			314.6179	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	51.5410	1.5962	82.2716	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	1.5225	3874.0629	(278)
Space and water heating			3956.3345	(279)

Pumps, fans and electric keep-hot	154.2094	1.5128	233.2880	(281)
Energy for lighting	163.7369	1.5338	251.1452	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.0518	1.4877	-733.5071	
PV Unit electricity exported	-269.6935	0.4514	-121.7494	
Total			-855.2565	(283)
Total Primary energy kWh/year			3585.5112	(286)

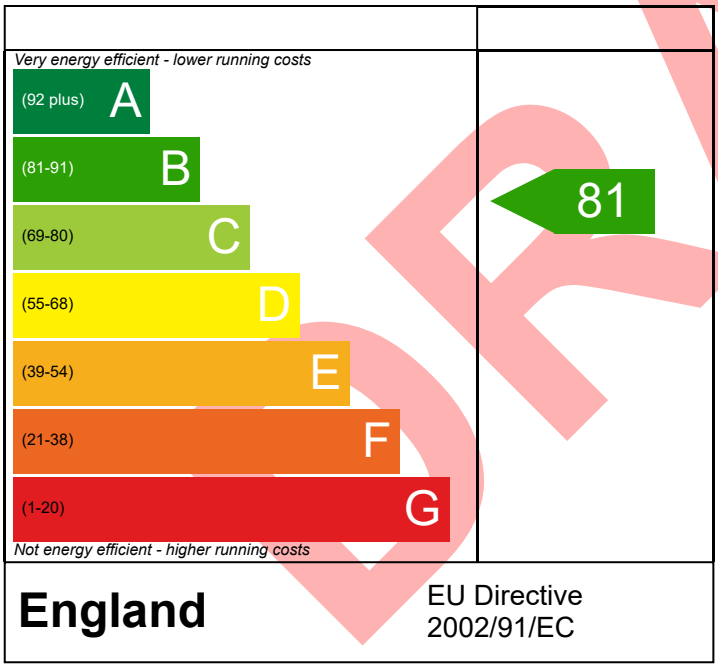
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	70.98 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

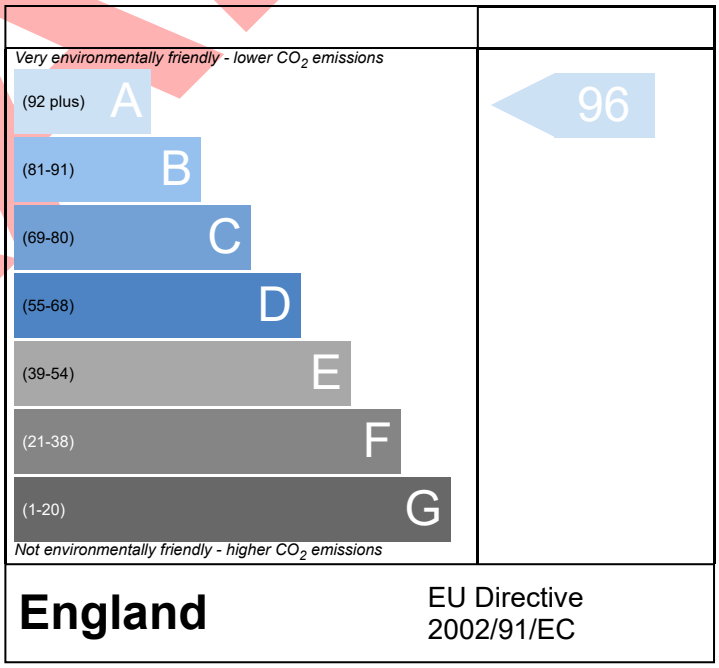
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:34:58

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	66 m^2
Site Reference	Unit 366 L07_Copy	Plot Reference	Unit 366 L07_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*10.63 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	5.05 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*57.39 kWh$_{PE}$/m^2*	
Dwelling primary energy	56.68 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*19.0 kWh/m^2*	
Dwelling fabric energy efficiency	18.9 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	24.21	0.14 **(!)**
Party wall: Party Wall (1)	55.93	0 **(!)**
Party wall: Party Wall (2)	3.85	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	7.88	South West	0.83	1.3
SE, Opening Type 1	11.81	South East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.86 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 366 L07_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 366 L07_Copy	**Prop Type Ref**	Unit 366 L07
Property			

SAP Rating	79 C	**DER**	5.05	**TER**	10.63
Environmental	96 A	**% DER < TER**			52.49
CO_2 Emissions (t/year)	0.34	**DFEE**	18.93	**TFEE**	19.00
Compliance Check	See BREL	**% DFEE < TFEE**			0.33
% DPER < TPER	1.24	**DPER**	56.68	**TPER**	57.39

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.5000 (1b)	x	2.4000 (2b)	=	159.6000	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.5000					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.6000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	43.9000	19.6900	24.2100	0.1400	3.3894	14.0000	338.9400	(29a)
Total net area of external elements Aum(A, m2)			43.9000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.7211			(33)
Party Wall 1			55.9300	0.0000	0.0000	20.0000	1118.6000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.5000			80.0000	5320.0000	(32d)
Party Ceiling 1			66.5000			80.0000	5320.0000	(32b)
Internal Wall 1			140.2900			9.0000	1262.6100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13437.1500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.0624 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240

E4 Jamb	23.2000	0.0500	1.1600	
E7 Party floor between dwellings (in blocks of flats)	16.1600	0.0700	1.1312	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	22.1400	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.0392 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 30.7603 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.9354	15.7675	15.5996	14.7602	14.5923	13.7529	13.7529	13.5851	14.0887	14.5923	14.9281	15.2638	(38)
Heat transfer coeff	46.6957	46.5278	46.3600	45.5206	45.3527	44.5133	44.5133	44.3454	44.8490	45.3527	45.6884	46.0242	(39)

Average = Sum(39)m / 12 = 45.4786

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7022	0.6997	0.6971	0.6845	0.6820	0.6694	0.6694	0.6668	0.6744	0.6820	0.6870	0.6921	(40)
HLP (average)												0.6839	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1583 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	83.0588	81.8106	79.9917	76.5116	73.9433	71.0793	69.4513	71.2564	73.2352	76.3103	79.8652	82.7406	(42a)
Hot water usage for baths	26.1000	25.7123	25.1665	24.1600	23.4064	22.5708	22.1194	22.6614	23.2516	24.1458	25.1729	26.0117	(42b)
Hot water usage for other uses	36.7327	35.3969	34.0612	32.7255	31.3897	30.0540	30.0540	31.3897	32.7255	34.0612	35.3969	36.7327	(42c)

Average daily hot water use (litres/day) 134.1695 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.8914	142.9198	139.2194	133.3971	128.7395	123.7040	121.6247	125.3076	129.2122	134.5173	140.4351	145.4849	(44)
Energy conte	231.0563	203.5159	213.9750	182.6139	173.3081	152.1085	147.0945	155.1570	159.3316	182.5387	200.0755	227.7943	(45)

Energy content (annual) Total = Sum(45)m = 2228.5693

Distribution loss (46)m = 0.15 x (45)m	34.6584	30.5274	32.0962	27.3921	25.9962	22.8163	22.0642	23.2735	23.8997	27.3808	30.0113	34.1691	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)

Total per year (kWh/year) = Sum(64)m = 2475.6013 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	93.6109	82.8294	87.9313	76.9623	74.4096	66.8193	65.6936	68.3743	69.2210	77.4788	82.7683	92.5262	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7552	19.3227	15.7143	11.8967	8.8930	7.5078	8.1125	10.5449	14.1533	17.9709	20.9747	22.3598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	282.0814	285.0085	277.6323	261.9291	242.1067	223.4764	211.0302	208.1031	215.4793	231.1825	251.0049	269.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	(71)
Water heating gains (Table 5)	125.8211	123.2580	118.1873	106.8921	100.0129	92.8046	88.2978	91.9010	96.1402	104.1381	114.9560	124.3632	(72)
Total internal gains	522.9304	520.8621	504.8066	473.9908	444.2853	417.0615	400.7133	403.8217	419.0457	446.5643	480.2084	509.6310	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	11.8100	36.7938	0.6300	0.8270	0.7700	156.8932	(77)
Southwest	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(79)

Solar gains	261.5773	445.5629	609.6386	755.3718	846.0793	839.9609	809.8120	742.1401	660.1097	492.4419	313.3093	223.8557	(83)
Total gains	784.5077	966.4250	1114.4452	1229.3625	1290.3646	1257.0225	1210.5252	1145.9618	1079.1553	939.0062	793.5177	733.4867	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	79.9333	80.2217	80.5122	81.9968	82.3004	83.8523	83.8523	84.1698	83.2246	82.3004	81.6955	81.0996	
alpha	6.3289	6.3481	6.3675	6.4665	6.4867	6.5902	6.5902	6.6113	6.5483	6.4867	6.4464	6.4066	
util living area	0.8610	0.7342	0.5934	0.4467	0.3267	0.2266	0.1618	0.1780	0.2867	0.4994	0.7534	0.8867	(86)
MIT	20.7806	20.9169	20.9770	20.9964	20.9996	21.0000	21.0000	21.0000	20.9999	20.9943	20.9214	20.7412	(87)
Th 2	20.3389	20.3411	20.3434	20.3545	20.3568	20.3680	20.3680	20.3702	20.3635	20.3568	20.3523	20.3478	(88)
util rest of house	0.8427	0.7107	0.5685	0.4232	0.3042	0.2042	0.1386	0.1536	0.2603	0.4693	0.7265	0.8706	(89)
MIT 2	20.1020	20.2557	20.3211	20.3513	20.3564	20.3679	20.3680	20.3702	20.3634	20.3519	20.2739	20.0650	(90)
Living area fraction									fLA = Living area / (4) =			0.3370	(91)
MIT	20.3307	20.4785	20.5421	20.5687	20.5732	20.5809	20.5810	20.5824	20.5779	20.5684	20.4921	20.2928	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3307	20.4785	20.5421	20.5687	20.5732	20.5809	20.5810	20.5824	20.5779	20.5684	20.4921	20.2928	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8425	0.7157	0.5761	0.4310	0.3118	0.2118	0.1464	0.1618	0.2692	0.4793	0.7325	0.8692	(94)
Useful gains	660.9362	691.6463	641.9935	529.8378	402.2774	266.2236	177.2049	185.4711	290.4875	450.0389	581.2287	637.5157	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	748.5635	724.8350	650.9921	531.1672	402.4220	266.2311	177.2054	185.4720	290.5269	452.0934	611.8637	740.6597	(97)
Space heating kWh	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(98a)
Space heating requirement - total per year (kWh/year)												195.5822	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												195.5822	
Space heating per m2											(98c) / (4) =	2.9411	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 100.0000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5760	10.4558	11.5760	11.2026	11.5760	11.2026	11.5760	11.5760	11.2026	11.5760	11.2026	11.5760	(231)
Lighting	19.0422	15.2763	13.7546	10.0772	7.7840	6.3596	7.1008	9.2299	11.9887	15.7298	17.7668	19.5714	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.8374	-25.0495	-40.6440	-51.2425	-60.2341	-57.9825	-57.0592	-51.4970	-42.0573	-30.6737	-18.2140	-13.3632	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.1177	-7.4452	-16.6195	-27.6808	-38.7105	-39.7745	-39.2119	-31.7414	-21.6778	-11.4252	-4.4487	-2.3730	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year
Space heating fuel - main system 1 195.5822 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 100.0000
Water heating fuel used 2475.6013 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)
mechanical ventilation fans (SFP = 0.7000) 136.2984 (230a)
Total electricity for the above, kWh/year 136.2984 (231)
Electricity for lighting (calculated in Appendix L) 153.6812 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation -708.0805 (233)
Wind generation 0.0000 (234)
Hydro-electric generation (Appendix N) 0.0000 (235a)
Electricity generated - Micro CHP (Appendix N) 0.0000 (235)

Appendix Q - special features

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2253.0826	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	195.5822	16.4900	32.2515	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	16.4900	408.2267	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	136.2984	16.4900	22.4756	(249)
Energy for lighting	153.6812	16.4900	25.3420	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-463.8543	16.4900	-76.4896	
PV Unit electricity exported	-244.2261	5.5900	-13.6522	
Total			-90.1418	(252)
Total energy cost			398.1540	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2855	(257)
SAP value	79.1617	
SAP rating (Section 12)	79	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	195.5822	0.1606	31.4176	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2475.6013	0.1413	349.7834	(264)
Space and water heating			381.2010	(265)
Pumps, fans and electric keep-hot	136.2984	0.1387	18.9063	(267)
Energy for lighting	153.6812	0.1443	22.1809	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-463.8543	0.1323	-61.3768	
PV Unit electricity exported	-244.2261	0.1233	-30.1190	
Total			-91.4957	(269)
Total CO2, kg/year			330.7925	(272)
CO2 emissions per m2			4.9700	(273)
EI value			96.0246	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		66.5000 (1b)	x	2.4000 (2b)	=	159.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.5000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.6000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	43.9000	19.6900	24.2100	0.1400	3.3894	14.0000	338.9400	(29a)
Total net area of external elements Aum(A, m2)			43.9000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.7211			(33)
Party Wall 1			55.9300	0.0000	0.0000	20.0000	1118.6000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.5000			80.0000	5320.0000	(32d)
Party Ceiling 1			66.5000			80.0000	5320.0000	(32b)
Internal Wall 1			140.2900			9.0000	1262.6100	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13437.1500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 202.0624 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.1600	0.0700	1.1312
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	22.1400	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.0392 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 30.7603 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.1032	16.1032	15.7675	14.7602	14.5923	13.9208	13.5851	13.5851	14.2566	15.0960	15.4317	15.2638	(38)
Heat transfer coeff	46.8636	46.8636	46.5278	45.5206	45.3527	44.6812	44.3454	44.3454	45.0169	45.8563	46.1921	46.0242	(39)
Average = Sum(39)m / 12 =												45.6325	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7047	0.7047	0.6997	0.6845	0.6820	0.6719	0.6668	0.6668	0.6769	0.6896	0.6946	0.6921	(40)
HLP (average)												0.6862	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1583 (42)
Hot water usage for mixer showers

83.0588	81.8106	79.9917	76.5116	73.9433	71.0793	69.4513	71.2564	73.2352	76.3103	79.8652	82.7406	(42a)

Hot water usage for baths

26.1000	25.7123	25.1665	24.1600	23.4064	22.5708	22.1194	22.6614	23.2516	24.1458	25.1729	26.0117	(42b)

Hot water usage for other uses

36.7327	35.3969	34.0612	32.7255	31.3897	30.0540	30.0540	31.3897	32.7255	34.0612	35.3969	36.7327	(42c)

Average daily hot water use (litres/day) 134.1695 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.8914	142.9198	139.2194	133.3971	128.7395	123.7040	121.6247	125.3076	129.2122	134.5173	140.4351	145.4849	(44)
Energy conte	231.0563	203.5159	213.9750	182.6139	173.3081	152.1085	147.0945	155.1570	159.3316	182.5387	200.0755	227.7943	(45)
Energy content (annual)										Total = Sum(45)m =		2228.5693	
Distribution loss (46)m = 0.15 x (45)m	34.6584	30.5274	32.0962	27.3921	25.9962	22.8163	22.0642	23.2735	23.8997	27.3808	30.0113	34.1691	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)

Total per year (kWh/year) = Sum(64)m = 2475.6013 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

93.6109	82.8294	87.9313	76.9623	74.4096	66.8193	65.6936	68.3743	69.2210	77.4788	82.7683	92.5262	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.7552	19.3227	15.7143	11.8967	8.8930	7.5078	8.1125	10.5449	14.1533	17.9709	20.9747	22.3598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	282.0814	285.0085	277.6323	261.9291	242.1067	223.4764	211.0302	208.1031	215.4793	231.1825	251.0049	269.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	(71)
Water heating gains (Table 5)													
	125.8211	123.2580	118.1873	106.8921	100.0129	92.8046	88.2978	91.9010	96.1402	104.1381	114.9560	124.3632	(72)
Total internal gains													
	522.9304	520.8621	504.8066	473.9908	444.2853	417.0615	400.7133	403.8217	419.0457	446.5643	480.2084	509.6310	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	11.8100	33.4622	0.6300	0.8270	0.7700	142.6869	(77)
Southwest	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(79)

Solar gains	237.8920	432.4913	618.4356	806.0340	893.6844	862.2965	841.6682	750.0695	663.6383	475.1307	292.8315	208.1992	(83)
Total gains	760.8224	953.3534	1123.2423	1280.0248	1337.9696	1279.3581	1242.3814	1153.8912	1082.6839	921.6950	773.0399	717.8302	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000	(85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	79.6469	79.6469	80.2217	81.9968	82.3004	83.5373	84.1698	84.1698	82.9142	81.3965	80.8048	81.0996	
alpha	6.3098	6.3098	6.3481	6.4665	6.4867	6.5692	6.6113	6.6113	6.5276	6.4264	6.3870	6.4066	
util living area													
	0.8845	0.7655	0.6241	0.4641	0.3489	0.2724	0.2177	0.2383	0.3407	0.5560	0.7919	0.9054	(86)
MIT	20.7303	20.8890	20.9674	20.9952	20.9993	20.9999	21.0000	21.0000	20.9995	20.9880	20.8884	20.6918	(87)
Th 2	20.3367	20.3367	20.3411	20.3545	20.3568	20.3657	20.3702	20.3702	20.3612	20.3501	20.3456	20.3478	(88)
util rest of house													
	0.8685	0.7432	0.6000	0.4416	0.3272	0.2502	0.1952	0.2141	0.3143	0.5256	0.7669	0.8915	(89)
MIT 2	20.0414	20.2207	20.3088	20.3501	20.3562	20.3657	20.3702	20.3702	20.3609	20.3395	20.2318	20.0064	(90)
Living area fraction									fLA = Living area / (4) =			0.3370	(91)
MIT	20.2736	20.4459	20.5307	20.5675	20.5729	20.5794	20.5824	20.5824	20.5761	20.5580	20.4531	20.2374	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2736	20.4459	20.5307	20.5675	20.5729	20.5794	20.5824	20.5824	20.5761	20.5580	20.4531	20.2374	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8668	0.7469	0.6070	0.4491	0.3345	0.2577	0.2028	0.2222	0.3232	0.5354	0.7711	0.8889	(94)
Useful gains	659.5127	712.1003	681.7671	574.8005	447.5175	329.6864	251.9844	256.4141	349.9080	493.4880	596.1068	638.1040	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	767.3236	756.6545	694.6943	576.6309	447.7632	329.7195	251.9897	256.4237	350.0571	497.9093	639.9012	761.1189	(97)
Space heating kWh													
	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(98a)
Space heating requirement - total per year (kWh/year)												247.6148	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												247.6148	
Space heating per m2										(98c) / (4) =		3.7235	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(219)
Space cooling fuel requirement													

(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5760	10.4558	11.5760	11.2026	11.5760	11.2026	11.5760	11.5760	11.2026	11.5760	11.2026	11.5760	(231)
Lighting	19.0422	15.2763	13.7546	10.0772	7.7840	6.3596	7.1008	9.2299	11.9887	15.7298	17.7668	19.5714	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.3659	-24.1373	-40.6748	-53.4156	-62.3565	-58.8247	-58.3796	-51.5126	-41.7801	-29.4038	-16.9601	-12.3644	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.6228	-6.9252	-16.5691	-29.8250	-41.2999	-40.8780	-40.9539	-31.7592	-21.4223	-10.5980	-3.9084	-2.0636	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	247.6148	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2475.6013	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.2984	(230a)
Total electricity for the above, kWh/year	136.2984	(231)
Electricity for lighting (calculated in Appendix L)	153.6812	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-713.0011	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2300.1947	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	247.6148	25.1600	62.2999	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	25.1600	622.8613	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	136.2984	25.1600	34.2927	(249)
Energy for lighting	153.6812	25.1600	38.6662	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.1755	25.1600	-116.7865	
PV Unit electricity exported	-248.8256	5.8100	-14.4568	
Total			-131.2433	(252)
Total energy cost			626.8767	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	247.6148	0.1602	39.6760	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2475.6013	0.1413	349.7834	(264)
Space and water heating			389.4594	(265)
Pumps, fans and electric keep-hot	136.2984	0.1387	18.9063	(267)
Energy for lighting	153.6812	0.1443	22.1809	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.1755	0.1320	-61.2773	
PV Unit electricity exported	-248.8256	0.1228	-30.5608	
Total			-91.8382	(269)
Total CO2, kg/year			338.7085	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	247.6148	1.5930	394.4398	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	1.5225	3769.0221	(278)
Space and water heating			4163.4620	(279)
Pumps, fans and electric keep-hot	136.2984	1.5128	206.1922	(281)
Energy for lighting	153.6812	1.5338	235.7213	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.1755	1.4878	-690.5810	
PV Unit electricity exported	-248.8256	0.4508	-112.1583	
Total			-802.7393	(283)
Total Primary energy kWh/year			3802.6362	(286)

SAP 10 EPC IMPROVEMENTS

Unit 366 L07_Copy

Current energy efficiency rating: C 79
Current environmental impact rating: A 96

N Solar water heating — Not applicable
U Solar photovoltaic panels — Not applicable
V2 Wind turbine — Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 79
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£758	£758	£0
Space heating	£97	£97	£0
Water heating	£623	£623	£0
Lighting	£39	£39	£0
Generated (PV)	-£131	-£131	£0
Total cost of fuels	£627	£627	£0
Total cost of uses	£628	£628	£0
Delivered energy	35 kWh/m²	35 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	57 kWh/m²	57 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.5000 (1b)	x	2.4000 (2b)	=	159.6000	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.5000					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.6000	(5)

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2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation — 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) — 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = — 72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	43.9000	19.6900	24.2100	0.1400	3.3894	14.0000	338.9400	(29a)
Total net area of external elements Aum(A, m2)			43.9000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.7211			(33)
Party Wall 1			55.9300	0.0000	0.0000	20.0000	1118.6000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.5000			80.0000	5320.0000	(32d)
Party Ceiling 1			66.5000			80.0000	5320.0000	(32b)
Internal Wall 1			140.2900			9.0000	1262.6100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13437.1500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.0624 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.1600	0.0700	1.1312
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	22.1400	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.0392 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	30.7603 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.9354	15.7675	15.5996	14.7602	14.5923	13.7529	13.7529	13.5851	14.0887	14.5923	14.9281	15.2638	(38)
Heat transfer coeff	46.6957	46.5278	46.3600	45.5206	45.3527	44.5133	44.5133	44.3454	44.8490	45.3527	45.6884	46.0242	(39)
Average = Sum(39)m / 12 =												45.4786	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7022	0.6997	0.6971	0.6845	0.6820	0.6694	0.6694	0.6668	0.6744	0.6820	0.6870	0.6921	(40)
HLP (average)												0.6839	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.1583 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
83.0588	81.8106	79.9917	76.5116	73.9433	71.0793	69.4513	71.2564	73.2352	76.3103	79.8652	82.7406	(42a)

Hot water usage for baths

26.1000	25.7123	25.1665	24.1600	23.4064	22.5708	22.1194	22.6614	23.2516	24.1458	25.1729	26.0117	(42b)

Hot water usage for other uses

36.7327	35.3969	34.0612	32.7255	31.3897	30.0540	30.0540	31.3897	32.7255	34.0612	35.3969	36.7327	(42c)

Average daily hot water use (litres/day)		134.1695 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.8914	142.9198	139.2194	133.3971	128.7395	123.7040	121.6247	125.3076	129.2122	134.5173	140.4351	145.4849	(44)
Energy conte	231.0563	203.5159	213.9750	182.6139	173.3081	152.1085	147.0945	155.1570	159.3316	182.5387	200.0755	227.7943	(45)
Energy content (annual)										Total = Sum(45)m =		2228.5693	

Distribution loss (46)m = 0.15 x (45)m

34.6584	30.5274	32.0962	27.3921	25.9962	22.8163	22.0642	23.2735	23.8997	27.3808	30.0113	34.1691	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
									Total per year (kWh/year) = Sum(64)m =		2475.6013	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

93.6109	82.8294	87.9313	76.9623	74.4096	66.8193	65.6936	68.3743	69.2210	77.4788	82.7683	92.5262	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7552	19.3227	15.7143	11.8967	8.8930	7.5078	8.1125	10.5449	14.1533	17.9709	20.9747	22.3598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	282.0814	285.0085	277.6323	261.9291	242.1067	223.4764	211.0302	208.1031	215.4793	231.1825	251.0049	269.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	(71)
Water heating gains (Table 5)	125.8211	123.2580	118.1873	106.8921	100.0129	92.8046	88.2978	91.9010	96.1402	104.1381	114.9560	124.3632	(72)
Total internal gains	522.9304	520.8621	504.8066	473.9908	444.2853	417.0615	400.7133	403.8217	419.0457	446.5643	480.2084	509.6310	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	11.8100	36.7938	0.6300	0.8270	0.7700	156.8932	(77)
Southwest	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	261.5773	445.5629	609.6386	755.3718	846.0793	839.9609	809.8120	742.1401	660.1097	492.4419	313.3093	223.8557	(83)
Total gains	784.5077	966.4250	1114.4452	1229.3625	1290.3646	1257.0225	1210.5252	1145.9618	1079.1553	939.0062	793.5177	733.4867	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	79.9333	80.2217	80.5122	81.9968	82.3004	83.8523	83.8523	84.1698	83.2246	82.3004	81.6955	81.0996	
alpha	6.3289	6.3481	6.3675	6.4665	6.4867	6.5902	6.5902	6.6113	6.5483	6.4867	6.4464	6.4066	
util living area	0.8610	0.7342	0.5934	0.4467	0.3267	0.2266	0.1618	0.1780	0.2867	0.4994	0.7534	0.8867	(86)
MIT	20.7806	20.9169	20.9770	20.9964	20.9996	21.0000	21.0000	21.0000	20.9999	20.9943	20.9214	20.7412	(87)
Th 2	20.3389	20.3411	20.3434	20.3545	20.3568	20.3680	20.3680	20.3702	20.3635	20.3568	20.3523	20.3478	(88)
util rest of house	0.8427	0.7107	0.5685	0.4232	0.3042	0.2042	0.1386	0.1536	0.2603	0.4693	0.7265	0.8706	(89)
MIT 2	20.1020	20.2557	20.3211	20.3513	20.3564	20.3679	20.3680	20.3702	20.3634	20.3519	20.2739	20.0650	(90)
Living area fraction										fLA = Living area / (4) =		0.3370	(91)
MIT	20.3307	20.4785	20.5421	20.5687	20.5732	20.5809	20.5810	20.5824	20.5779	20.5684	20.4921	20.2928	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3307	20.4785	20.5421	20.5687	20.5732	20.5809	20.5810	20.5824	20.5779	20.5684	20.4921	20.2928	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8425	0.7157	0.5761	0.4310	0.3118	0.2118	0.1464	0.1618	0.2692	0.4793	0.7325	0.8692	(94)
Useful gains	660.9362	691.6463	641.9935	529.8378	402.2774	266.2236	177.2049	185.4711	290.4875	450.0389	581.2287	637.5157	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	748.5635	724.8350	650.9921	531.1672	402.4220	266.2311	177.2054	185.4720	290.5269	452.0934	611.8637	740.6597	(97)
Space heating kWh	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(98a)
Space heating requirement - total per year (kWh/year)												195.5822	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												195.5822	
Space heating per m2										(98c) / (4) =		2.9411	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5760	10.4558	11.5760	11.2026	11.5760	11.2026	11.5760	11.5760	11.2026	11.5760	11.2026	11.5760	(231)
Lighting	19.0422	15.2763	13.7546	10.0772	7.7840	6.3596	7.1008	9.2299	11.9887	15.7298	17.7668	19.5714	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.8374	-25.0495	-40.6440	-51.2425	-60.2341	-57.9825	-57.0592	-51.4970	-42.0573	-30.6737	-18.2140	-13.3632	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.1177	-7.4452	-16.6195	-27.6808	-38.7105	-39.7745	-39.2119	-31.7414	-21.6778	-11.4252	-4.4487	-2.3730	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	195.5822	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2475.6013	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.2984	(230a)
Total electricity for the above, kWh/year	136.2984	(231)
Electricity for lighting (calculated in Appendix L)	153.6812	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-708.0805	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2253.0826	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	195.5822	16.4900	32.2515	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	16.4900	408.2267	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	136.2984	16.4900	22.4756	(249)
Energy for lighting	153.6812	16.4900	25.3420	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-463.8543	16.4900	-76.4896	
PV Unit electricity exported	-244.2261	5.5900	-13.6522	
Total			-90.1418	(252)
Total energy cost			398.1540	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2855	(257)
SAP value	79.1617	
SAP rating (Section 12)	79	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	195.5822	0.1606	31.4176	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2475.6013	0.1413	349.7834	(264)
Space and water heating			381.2010	(265)
Pumps, fans and electric keep-hot	136.2984	0.1387	18.9063	(267)
Energy for lighting	153.6812	0.1443	22.1809	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-463.8543	0.1323	-61.3768	
PV Unit electricity exported	-244.2261	0.1233	-30.1190	
Total			-91.4957	(269)
Total CO2, kg/year			330.7925	(272)
CO2 emissions per m2			4.9700	(273)
EI value			96.0246	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.5000	(1b)	x 2.4000	(2b) =	159.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		159.6000	(5)

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2. Ventilation rate

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m3 per hour

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery		
If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	43.9000	19.6900	24.2100	0.1400	3.3894	14.0000	338.9400	(29a)
Total net area of external elements Aum(A, m2)			43.9000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.7211			(33)
Party Wall 1			55.9300	0.0000	0.0000	20.0000	1118.6000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.5000			80.0000	5320.0000	(32d)
Party Ceiling 1			66.5000			80.0000	5320.0000	(32b)
Internal Wall 1			140.2900			9.0000	1262.6100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13437.1500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.0624 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.1600	0.0700	1.1312
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	22.1400	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.0392 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	30.7603 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.1032	16.1032	15.7675	14.7602	14.5923	13.9208	13.5851	13.5851	14.2566	15.0960	15.4317	15.2638	(38)
Heat transfer coeff	46.8636	46.8636	46.5278	45.5206	45.3527	44.6812	44.3454	44.3454	45.0169	45.8563	46.1921	46.0242	(39)
Average = Sum(39)m / 12 =												45.6325	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7047	0.7047	0.6997	0.6845	0.6820	0.6719	0.6668	0.6668	0.6769	0.6896	0.6946	0.6921	(40)
HLP (average)												0.6862	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.1583 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
83.0588	81.8106	79.9917	76.5116	73.9433	71.0793	69.4513	71.2564	73.2352	76.3103	79.8652	82.7406	(42a)

Hot water usage for baths

26.1000	25.7123	25.1665	24.1600	23.4064	22.5708	22.1194	22.6614	23.2516	24.1458	25.1729	26.0117	(42b)

Hot water usage for other uses

36.7327	35.3969	34.0612	32.7255	31.3897	30.0540	30.0540	31.3897	32.7255	34.0612	35.3969	36.7327	(42c)

Average daily hot water use (litres/day)		134.1695 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.8914	142.9198	139.2194	133.3971	128.7395	123.7040	121.6247	125.3076	129.2122	134.5173	140.4351	145.4849	(44)
Energy conte	231.0563	203.5159	213.9750	182.6139	173.3081	152.1085	147.0945	155.1570	159.3316	182.5387	200.0755	227.7943	(45)
Energy content (annual)										Total = Sum(45)m =		2228.5693	
Distribution loss (46)m = 0.15 x (45)m	34.6584	30.5274	32.0962	27.3921	25.9962	22.8163	22.0642	23.2735	23.8997	27.3808	30.0113	34.1691	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
										Total per year (kWh/year) = Sum(64)m =		2475.6013	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	93.6109	82.8294	87.9313	76.9623	74.4096	66.8193	65.6936	68.3743	69.2210	77.4788	82.7683	92.5262	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.7552	19.3227	15.7143	11.8967	8.8930	7.5078	8.1125	10.5449	14.1533	17.9709	20.9747	22.3598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	282.0814	285.0085	277.6323	261.9291	242.1067	223.4764	211.0302	208.1031	215.4793	231.1825	251.0049	269.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	(71)
Water heating gains (Table 5)													
	125.8211	123.2580	118.1873	106.8921	100.0129	92.8046	88.2978	91.9010	96.1402	104.1381	114.9560	124.3632	(72)
Total internal gains													
	522.9304	520.8621	504.8066	473.9908	444.2853	417.0615	400.7133	403.8217	419.0457	446.5643	480.2084	509.6310	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	11.8100	33.4622	0.6300	0.8270	0.7700	142.6869	(77)
Southwest	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(79)

Solar gains	237.8920	432.4913	618.4356	806.0340	893.6844	862.2965	841.6682	750.0695	663.6383	475.1307	292.8315	208.1992	(83)
Total gains	760.8224	953.3534	1123.2423	1280.0248	1337.9696	1279.3581	1242.3814	1153.8912	1082.6839	921.6950	773.0399	717.8302	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	79.6469	79.6469	80.2217	81.9968	82.3004	83.5373	84.1698	84.1698	82.9142	81.3965	80.8048	81.0996	
alpha	6.3098	6.3098	6.3481	6.4665	6.4867	6.5692	6.6113	6.6113	6.5276	6.4264	6.3870	6.4066	
util living area													
	0.8845	0.7655	0.6241	0.4641	0.3489	0.2724	0.2177	0.2383	0.3407	0.5560	0.7919	0.9054	(86)
MIT	20.7303	20.8890	20.9674	20.9952	20.9993	20.9999	21.0000	21.0000	20.9995	20.9880	20.8884	20.6918	(87)
Th 2	20.3367	20.3367	20.3411	20.3545	20.3568	20.3657	20.3702	20.3702	20.3612	20.3501	20.3456	20.3478	(88)
util rest of house													
	0.8685	0.7432	0.6000	0.4416	0.3272	0.2502	0.1952	0.2141	0.3143	0.5256	0.7669	0.8915	(89)
MIT 2	20.0414	20.2207	20.3088	20.3501	20.3562	20.3657	20.3702	20.3702	20.3609	20.3395	20.2318	20.0064	(90)
Living area fraction										fLA = Living area / (4) =		0.3370	(91)
MIT	20.2736	20.4459	20.5307	20.5675	20.5729	20.5794	20.5824	20.5824	20.5761	20.5580	20.4531	20.2374	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2736	20.4459	20.5307	20.5675	20.5729	20.5794	20.5824	20.5824	20.5761	20.5580	20.4531	20.2374	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8668	0.7469	0.6070	0.4491	0.3345	0.2577	0.2028	0.2222	0.3232	0.5354	0.7711	0.8889	(94)
Useful gains	659.5127	712.1003	681.7671	574.8005	447.5175	329.6864	251.9844	256.4141	349.9080	493.4880	596.1068	638.1040	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	767.3236	756.6545	694.6943	576.6309	447.7632	329.7195	251.9897	256.4237	350.0571	497.9093	639.9012	761.1189	(97)
Space heating kWh													
	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(98a)
Space heating requirement - total per year (kWh/year)												247.6148	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												247.6148	
Space heating per m2											(98c) / (4) =	3.7235	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement												

	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5760	10.4558	11.5760	11.2026	11.5760	11.2026	11.5760	11.5760	11.2026	11.5760	11.2026	11.5760	(231)
Lighting	19.0422	15.2763	13.7546	10.0772	7.7840	6.3596	7.1008	9.2299	11.9887	15.7298	17.7668	19.5714	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.3659	-24.1373	-40.6748	-53.4156	-62.3565	-58.8247	-58.3796	-51.5126	-41.7801	-29.4038	-16.9601	-12.3644	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.6228	-6.9252	-16.5691	-29.8250	-41.2999	-40.8780	-40.9539	-31.7592	-21.4223	-10.5980	-3.9084	-2.0636	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	247.6148	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2475.6013	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.2984	(230a)
Total electricity for the above, kWh/year	136.2984	(231)
Electricity for lighting (calculated in Appendix L)	153.6812	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-713.0011	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2300.1947	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	247.6148	25.1600	62.2999	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	25.1600	622.8613	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	136.2984	25.1600	34.2927	(249)
Energy for lighting	153.6812	25.1600	38.6662	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.1755	25.1600	-116.7865	
PV Unit electricity exported	-248.8256	5.8100	-14.4568	
Total			-131.2433	(252)
Total energy cost			626.8767	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	247.6148	0.1602	39.6760	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2475.6013	0.1413	349.7834	(264)
Space and water heating			389.4594	(265)
Pumps, fans and electric keep-hot	136.2984	0.1387	18.9063	(267)
Energy for lighting	153.6812	0.1443	22.1809	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.1755	0.1320	-61.2773	
PV Unit electricity exported	-248.8256	0.1228	-30.5608	
Total			-91.8382	(269)
Total CO2, kg/year			338.7085	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	

Space heating - main system 1	247.6148	1.5930	394.4398	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	1.5225	3769.0221	(278)
Space and water heating			4163.4620	(279)
Pumps, fans and electric keep-hot	136.2984	1.5128	206.1922	(281)
Energy for lighting	153.6812	1.5338	235.7213	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.1755	1.4878	-690.5810	
PV Unit electricity exported	-248.8256	0.4508	-112.1583	
Total			-802.7393	(283)
Total Primary energy kWh/year			3802.6362	(286)

Predicted Energy Assessment

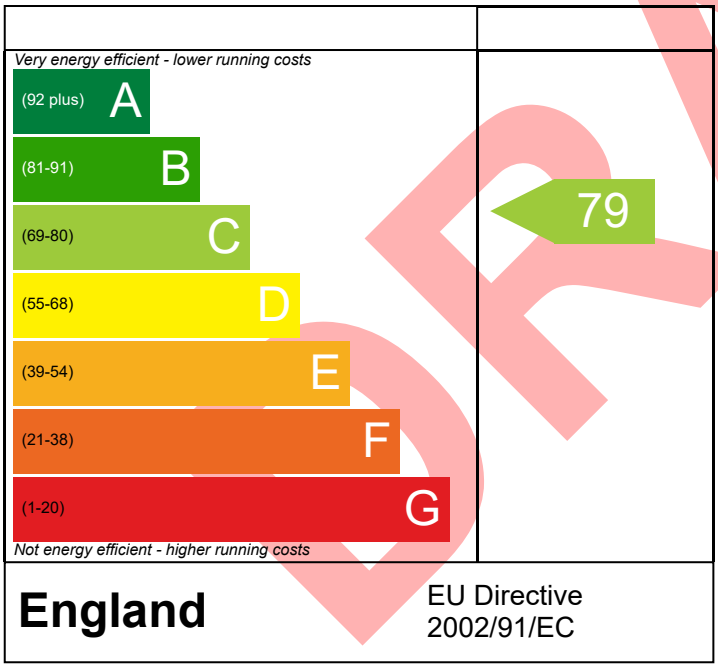
elmhurst energy

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	66.5 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

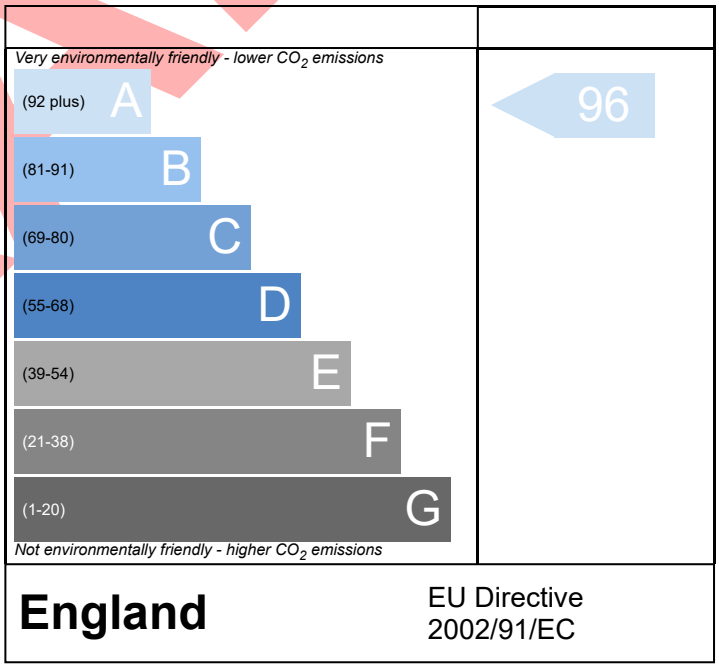
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:00

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	49 m^2
Site Reference	Unit 367 L07_Copy	Plot Reference	Unit 367 L07_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*13.35 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	6.27 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*72.57 kWh$_{PE}$/m^2*	
Dwelling primary energy	69.63 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*22.0 kWh/m^2*	
Dwelling fabric energy efficiency	21.1 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	7.89	0.14 **(!)**
Party wall: Party Wall (1)	24.84	0 **(!)**
Party wall: Party Wall (2)	39.01	0 **(!)**
Exposed roof: Roof (1)	27.1	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	6.28	North East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E15: Flat roof with parapet	Calculated by person with suitable expertise	0.56	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.12	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.63 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 367 L07_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 367 L07_Copy	**Prop Type Ref**	Unit 367 L07
Property			

SAP Rating	78 C	**DER**	6.27	**TER**	13.35
Environmental	96 A	**% DER < TER**			53.03
CO_2 Emissions (t/year)	0.3	**DFEE**	21.13	**TFEE**	22.00
Compliance Check	See BREL	**% DFEE < TFEE**			3.92
% DPER < TPER	4.06	**DPER**	69.63	**TPER**	72.57

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.8100 (1b)	x	2.4000 (2b)	=	117.1440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.8100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	117.1440	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.2800	1.2357	7.7605			(27)
External Wall 1	14.1700	6.2800	7.8900	0.1400	1.1046	14.0000	110.4600	(29a)
External Roof 1	27.1000		27.1000	0.1100	2.9810	9.0000	243.9000	(30)
Total net area of external elements Aum(A, m2)			41.2700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	11.8461			(33)
Party Wall 1			24.8400	0.0000	0.0000	20.0000	496.8000	(32)
Wall to corridor			39.0100	0.0000	0.0000	20.0000	780.2000	(32)
Party Floor 1			48.8100			80.0000	3904.8000	(32d)
Party Ceiling 1			22.5800			80.0000	1806.4000	(32b)
Internal Wall 1			72.6800			9.0000	654.1200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	7996.6800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		163.8328 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	2.7000	0.0500	0.1350	
E4 Jamb	9.2800	0.0500	0.4640	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	13.1500	0.0000	0.0000	
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000	
E15 Flat roof with parapet	5.2500	0.5600	2.9400	
P4 Party wall - Roof (insulation at ceiling level)	10.6400	0.1200	1.2768	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				5.1398 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	16.9859 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.1418	11.0295	10.9171	10.3554	10.2430	9.6813	9.6813	9.5689	9.9060	10.2430	10.4677	10.6924	(38)
Heat transfer coeff	28.1277	28.0153	27.9030	27.3412	27.2289	26.6671	26.6671	26.5548	26.8918	27.2289	27.4536	27.6783	(39)
Average = Sum(39)m / 12 =												27.3132	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5763	0.5740	0.5717	0.5602	0.5579	0.5463	0.5463	0.5440	0.5509	0.5579	0.5625	0.5671	(40)
HLP (average)												0.5596	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6551 (42)

Hot water usage for mixer showers

71.4595	70.3856	68.8207	65.8266	63.6170	61.1529	59.7523	61.3053	63.0077	65.6534	68.7119	71.1857	(42a)

Hot water usage for baths

22.4723	22.1385	21.6685	20.8020	20.1531	19.4336	19.0450	19.5117	20.0198	20.7897	21.6741	22.3963	(42b)

Hot water usage for other uses

31.5802	30.4318	29.2834	28.1350	26.9867	25.8383	25.8383	26.9867	28.1350	29.2834	30.4318	31.5802	(42c)

Average daily hot water use (litres/day) 115.4278 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	125.5119	122.9558	119.7726	114.7636	110.7568	106.4248	104.6356	107.8037	111.1626	115.7265	120.8177	125.1621	(44)
Energy conte	198.7801	175.0875	184.0861	157.1056	149.0999	130.8617	126.5476	133.4834	137.0746	157.0398	172.1270	195.9736	(45)
Energy content (annual)										Total = Sum(45)m =		1917.2669	

Distribution loss (46)m = 0.15 x (45)m

29.8170	26.2631	27.6129	23.5658	22.3650	19.6293	18.9821	20.0225	20.5612	23.5560	25.8191	29.3960	(46)

Water storage loss:

Store volume 143.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)

Temperature factor from Table 2b 0.6000 (49)

Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss / Combi loss

Total heat required for water heating calculated for each month

219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS / PV diverter / Solar input / FGHRS

Output from w/h

219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
									Total per year (kWh/year) = Sum(64)m =		2164.2989	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

82.8790	73.3769	77.9933	68.4808	66.3603	59.7547	58.8617	61.1679	61.8205	69.0004	73.4754	81.9459	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.4912	15.5356	12.6344	9.5650	7.1500	6.0363	6.5224	8.4781	11.3793	14.4487	16.8637	17.9774	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.1398	217.3723	211.7465	199.7699	184.6516	170.4425	160.9500	158.7175	164.3433	176.3199	191.4382	205.6473	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	(71)
Water heating gains (Table 5)	111.3965	109.1918	104.8296	95.1122	89.1940	82.9927	79.1152	82.2149	85.8618	92.7424	102.0492	110.1423	(72)
Total internal gains	423.7160	421.7881	408.8990	384.1356	360.6840	339.1599	326.2761	329.0989	341.2728	363.1994	390.0395	413.4554	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.2800	11.2829	0.6300	0.8270	0.7700	25.5836	(75)

Solar gains	25.5836	52.0761	93.8246	154.0869	207.1231	220.8151	206.5680	164.6784	114.3267	63.6411	32.1908	20.8928	(83)
Total gains	449.2996	473.8642	502.7235	538.2225	567.8071	559.9750	532.8441	493.7774	455.5996	426.8405	422.2303	434.3482	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.9720	79.2887	79.6080	81.2436	81.5788	83.2972	83.2972	83.6497	82.6012	81.5788	80.9111	80.2543	
alpha	6.2648	6.2859	6.3072	6.4162	6.4386	6.5531	6.5531	6.5766	6.5067	6.4386	6.3941	6.3503	
util living area	0.8808	0.8406	0.7546	0.6039	0.4446	0.3047	0.2202	0.2474	0.4066	0.6467	0.8173	0.8916	(86)
MIT	20.7391	20.8140	20.9109	20.9796	20.9972	20.9998	21.0000	21.0000	20.9989	20.9747	20.8708	20.7252	(87)
Th 2	20.4514	20.4535	20.4556	20.4660	20.4681	20.4785	20.4785	20.4806	20.4743	20.4681	20.4639	20.4597	(88)
util rest of house	0.8671	0.8240	0.7333	0.5794	0.4195	0.2799	0.1941	0.2194	0.3758	0.6173	0.7971	0.8788	(89)
MIT 2	20.1586	20.2487	20.3617	20.4461	20.4657	20.4784	20.4785	20.4806	20.4735	20.4443	20.3263	20.1498	(90)
Living area fraction										fLA = Living area / (4) =		0.5530	(91)
MIT	20.4796	20.5613	20.6654	20.7411	20.7596	20.7667	20.7669	20.7678	20.7640	20.7376	20.6274	20.4679	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.4796	20.5613	20.6654	20.7411	20.7596	20.7667	20.7669	20.7678	20.7640	20.7376	20.6274	20.4679	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8678	0.8274	0.7417	0.5921	0.4333	0.2936	0.2085	0.2349	0.3928	0.6323	0.8035	0.8790	(94)
Useful gains	389.9083	392.0794	372.8555	318.6871	246.0314	164.4113	111.1155	115.9793	178.9563	269.9043	339.2485	381.7887	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	455.0952	438.7555	395.2561	323.7494	246.6835	164.4491	111.1185	115.9858	179.2075	276.0363	371.3745	450.2689	(97)
Space heating kWh	48.4990	31.3664	16.6661	3.6449	0.4852	0.0000	0.0000	0.0000	0.0000	4.5622	23.1308	50.9493	(98a)
Space heating requirement - total per year (kWh/year)												179.3038	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	48.4990	31.3664	16.6661	3.6449	0.4852	0.0000	0.0000	0.0000	0.0000	4.5622	23.1308	50.9493	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												179.3038	
Space heating per m2										(98c) / (4) =		3.6735	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	48.4990	31.3664	16.6661	3.6449	0.4852	0.0000	0.0000	0.0000	0.0000	4.5622	23.1308	50.9493	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	48.4990	31.3664	16.6661	3.6449	0.4852	0.0000	0.0000	0.0000	0.0000	4.5622	23.1308	50.9493	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.4966	7.6744	8.4966	8.2225	8.4966	8.2225	8.4966	8.4966	8.2225	8.4966	8.2225	8.4966	(231)
Lighting	15.3100	12.2822	11.0588	8.1021	6.2583	5.1131	5.7091	7.4209	9.6390	12.6468	14.2846	15.7355	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.7118	-18.7024	-30.5023	-38.5410	-45.4184	-43.7828	-43.0941	-38.8073	-31.5721	-22.9240	-13.5325	-9.8625	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.1738	-5.1018	-11.4465	-19.2750	-27.0643	-27.8298	-27.4301	-22.1696	-15.1176	-7.9159	-3.0693	-1.6651	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1	179.3038	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2164.2989	(219)
Space cooling fuel	0.0000	(221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)

mechanical ventilation fans (SFP = 0.7000)	100.0410	(230a)
Total electricity for the above, kWh/year	100.0410	(231)
Electricity for lighting (calculated in Appendix L)	123.5603	(232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	-518.7101	(233)
Wind generation	0.0000	(234)

Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2048.4939	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	179.3038	16.4900	29.5672	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	16.4900	356.8929	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	100.0410	16.4900	16.4968	(249)
Energy for lighting	123.5603	16.4900	20.3751	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-348.4513	16.4900	-57.4596	
PV Unit electricity exported	-170.2588	5.5900	-9.5175	
Total			-66.9771	(252)
Total energy cost			356.3549	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.3675	(257)
SAP value	77.8324	
SAP rating (Section 12)	78	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	179.3038	0.1588	28.4771	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2164.2989	0.1413	305.7097	(264)
Space and water heating			334.1868	(265)
Pumps, fans and electric keep-hot	100.0410	0.1387	13.8769	(267)
Energy for lighting	123.5603	0.1443	17.8336	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-348.4513	0.1322	-46.0791	
PV Unit electricity exported	-170.2588	0.1232	-20.9763	
Total			-67.0554	(269)
Total CO2, kg/year			298.8419	(272)
CO2 emissions per m2			6.1200	(273)
EI value			95.7313	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.8100 (1b)	x	2.4000 (2b)	=	117.1440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 48.8100						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	117.1440	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.2800	1.2357	7.7605			(27)
External Wall 1	14.1700	6.2800	7.8900	0.1400	1.1046	14.0000	110.4600	(29a)
External Roof 1	27.1000		27.1000	0.1100	2.9810	9.0000	243.9000	(30)
Total net area of external elements Aum(A, m2)			41.2700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		11.8461			(33)
Party Wall 1			24.8400	0.0000	0.0000	20.0000	496.8000	(32)
Wall to corridor			39.0100	0.0000	0.0000	20.0000	780.2000	(32)
Party Floor 1			48.8100			80.0000	3904.8000	(32d)
Party Ceiling 1			22.5800			80.0000	1806.4000	(32b)
Internal Wall 1			72.6800			9.0000	654.1200	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7996.6800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 163.8328 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.7000	0.0500	0.1350
E4 Jamb	9.2800	0.0500	0.4640
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	13.1500	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000
E15 Flat roof with parapet	5.2500	0.5600	2.9400
P4 Party wall - Roof (insulation at ceiling level)	10.6400	0.1200	1.2768

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.1398 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 16.9859 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.2542	11.2542	11.0295	10.3554	10.2430	9.7936	9.5689	9.5689	10.0183	10.5801	10.8048	10.6924	(38)
Heat transfer coeff	28.2400	28.2400	28.0153	27.3412	27.2289	26.7795	26.5548	26.5548	27.0042	27.5659	27.7906	27.6783	(39)
Average = Sum(39)m / 12 =												27.4161	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5786	0.5786	0.5740	0.5602	0.5579	0.5486	0.5440	0.5440	0.5533	0.5648	0.5694	0.5671	(40)
HLP (average)												0.5617	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6551 (42)
Hot water usage for mixer showers

71.4595	70.3856	68.8207	65.8266	63.6170	61.1529	59.7523	61.3053	63.0077	65.6534	68.7119	71.1857	(42a)

Hot water usage for baths

22.4723	22.1385	21.6685	20.8020	20.1531	19.4336	19.0450	19.5117	20.0198	20.7897	21.6741	22.3963	(42b)

Hot water usage for other uses

31.5802	30.4318	29.2834	28.1350	26.9867	25.8383	25.8383	26.9867	28.1350	29.2834	30.4318	31.5802	(42c)

Average daily hot water use (litres/day) 115.4278 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	125.5119	122.9558	119.7726	114.7636	110.7568	106.4248	104.6356	107.8037	111.1626	115.7265	120.8177	125.1621	(44)
Energy conte	198.7801	175.0875	184.0861	157.1056	149.0999	130.8617	126.5476	133.4834	137.0746	157.0398	172.1270	195.9736	(45)
Energy content (annual)										Total = Sum(45)m =		1917.2669	
Distribution loss (46)m = 0.15 x (45)m	29.8170	26.2631	27.6129	23.5658	22.3650	19.6293	18.9821	20.0225	20.5612	23.5560	25.8191	29.3960	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)

Total per year (kWh/year) = Sum(64)m = 2164.2989 (64)
Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month

82.8790	73.3769	77.9933	68.4808	66.3603	59.7547	58.8617	61.1679	61.8205	69.0004	73.4754	81.9459	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	17.4912	15.5356	12.6344	9.5650	7.1500	6.0363	6.5224	8.4781	11.3793	14.4487	16.8637	17.9774	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	215.1398	217.3723	211.7465	199.7699	184.6516	170.4425	160.9500	158.7175	164.3433	176.3199	191.4382	205.6473	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	(71)
Water heating gains (Table 5)													
	111.3965	109.1918	104.8296	95.1122	89.1940	82.9927	79.1152	82.2149	85.8618	92.7424	102.0492	110.1423	(72)
Total internal gains													
	423.7160	421.7881	408.8990	384.1356	360.6840	339.1599	326.2761	329.0989	341.2728	363.1994	390.0395	413.4554	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.2800	10.0309	0.6300	0.8270	0.7700	22.7447	(75)

Solar gains	22.7447	49.2415	92.5542	160.3674	214.4517	222.8237	210.7732	162.6535	111.8389	59.7473	29.3775	19.0187	(83)
Total gains	446.4607	471.0296	501.4532	544.5030	575.1357	561.9836	537.0493	491.7525	453.1117	422.9467	419.4170	432.4741	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.6579	78.6579	79.2887	81.2436	81.5788	82.9478	83.6497	83.6497	82.2576	80.5813	79.9298	80.2543	
alpha	6.2439	6.2439	6.2859	6.4162	6.4386	6.5299	6.5766	6.5766	6.4838	6.3721	6.3287	6.3503	
util living area													
	0.8934	0.8625	0.7903	0.6418	0.4852	0.3713	0.3015	0.3346	0.4863	0.7056	0.8425	0.9038	(86)
MIT	20.7039	20.7698	20.8760	20.9691	20.9950	20.9993	20.9998	20.9997	20.9961	20.9538	20.8345	20.6890	(87)
Th 2	20.4493	20.4493	20.4535	20.4660	20.4681	20.4764	20.4806	20.4806	20.4723	20.4618	20.4577	20.4597	(88)
util rest of house													
	0.8809	0.8476	0.7710	0.6184	0.4607	0.3465	0.2759	0.3067	0.4557	0.6778	0.8241	0.8923	(89)
MIT 2	20.1144	20.1926	20.3199	20.4350	20.4635	20.4759	20.4805	20.4804	20.4690	20.4166	20.2787	20.1060	(90)
Living area fraction									fLA = Living area / (4) =			0.5530	(91)
MIT	20.4404	20.5118	20.6274	20.7303	20.7574	20.7653	20.7677	20.7676	20.7605	20.7136	20.5861	20.4284	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.4404	20.5118	20.6274	20.7303	20.7574	20.7653	20.7677	20.7676	20.7605	20.7136	20.5861	20.4284	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8806	0.8494	0.7773	0.6301	0.4740	0.3602	0.2901	0.3221	0.4724	0.6910	0.8286	0.8916	(94)
Useful gains	393.1718	400.0898	389.7623	343.0688	272.6396	202.4289	155.7829	158.4049	214.0651	292.2564	347.5219	385.5809	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	467.1010	457.8206	420.9978	350.7963	273.8518	202.5946	155.8153	158.4675	214.9666	303.6011	388.6816	463.0128	(97)
Space heating kWh													
	55.0033	38.7951	23.2392	5.5638	0.9019	0.0000	0.0000	0.0000	0.0000	8.4405	29.6350	57.6093	(98a)
Space heating requirement - total per year (kWh/year)												219.1881	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	55.0033	38.7951	23.2392	5.5638	0.9019	0.0000	0.0000	0.0000	0.0000	8.4405	29.6350	57.6093	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												219.1881	
Space heating per m2										(98c) / (4) =		4.4906	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	55.0033	38.7951	23.2392	5.5638	0.9019	0.0000	0.0000	0.0000	0.0000	8.4405	29.6350	57.6093	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	55.0033	38.7951	23.2392	5.5638	0.9019	0.0000	0.0000	0.0000	0.0000	8.4405	29.6350	57.6093	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
Efficiency of water heater												100.0000	(216)

(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.4966	7.6744	8.4966	8.2225	8.4966	8.2225	8.4966	8.4966	8.2225	8.4966	8.2225	8.4966	(231)
Lighting	15.3100	12.2822	11.0588	8.1021	6.2583	5.1131	5.7091	7.4209	9.6390	12.6468	14.2846	15.7355	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.6066	-18.0158	-30.5715	-40.2429	-47.0634	-44.4325	-44.1130	-38.8194	-31.3607	-21.9848	-12.5874	-9.1140	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.8386	-4.7393	-11.3630	-20.7357	-28.8710	-28.6056	-28.6545	-22.1821	-14.9388	-7.3188	-2.7000	-1.4554	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	219.1881	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2164.2989	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	100.0410	(230a)
Total electricity for the above, kWh/year	100.0410	(231)
Electricity for lighting (calculated in Appendix L)	123.5603	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-522.3147	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2084.7735	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	219.1881	25.1600	55.1477	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	25.1600	544.5376	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	100.0410	25.1600	25.1703	(249)
Energy for lighting	123.5603	25.1600	31.0878	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-348.9119	25.1600	-87.7862	
PV Unit electricity exported	-173.4029	5.8100	-10.0747	
Total			-97.8609	(252)
Total energy cost			558.0825	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	219.1881	0.1581	34.6561	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2164.2989	0.1413	305.7097	(264)
Space and water heating			340.3658	(265)
Pumps, fans and electric keep-hot	100.0410	0.1387	13.8769	(267)
Energy for lighting	123.5603	0.1443	17.8336	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-348.9119	0.1319	-46.0344	
PV Unit electricity exported	-173.4029	0.1227	-21.2739	
Total			-67.3083	(269)
Total CO2, kg/year			304.7681	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	219.1881	1.5853	347.4798	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	1.5223	3294.7406	(278)
Space and water heating			3642.2204	(279)
Pumps, fans and electric keep-hot	100.0410	1.5128	151.3420	(281)
Energy for lighting	123.5603	1.5338	189.5210	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-348.9119	1.4875	-518.9970	
PV Unit electricity exported	-173.4029	0.4502	-78.0731	
Total			-597.0701	(283)
Total Primary energy kWh/year			3386.0132	(286)

SAP 10 EPC IMPROVEMENTS

Unit 367 L07_Copy

Current energy efficiency rating: C 78
Current environmental impact rating: A 96

N Solar water heating	Not applicable
U Solar photovoltaic panels	Not applicable
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 78
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£656	£656	£0
Space heating	£80	£80	£0
Water heating	£545	£545	£0
Lighting	£31	£31	£0
Generated (PV)	-£98	-£98	£0
Total cost of fuels	£558	£558	£0
Total cost of uses	£558	£558	£0
Delivered energy	43 kWh/m²	43 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	69 kWh/m²	69 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.8100	(1b)	x 2.4000	(2b) =	117.1440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.8100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		117.1440	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.2800	1.2357	7.7605			(27)
External Wall 1	14.1700	6.2800	7.8900	0.1400	1.1046	14.0000	110.4600	(29a)
External Roof 1	27.1000		27.1000	0.1100	2.9810	9.0000	243.9000	(30)
Total net area of external elements Aum(A, m2)			41.2700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		11.8461			(33)
Party Wall 1			24.8400	0.0000	0.0000	20.0000	496.8000	(32)
Wall to corridor			39.0100	0.0000	0.0000	20.0000	780.2000	(32)
Party Floor 1			48.8100			80.0000	3904.8000	(32d)
Party Ceiling 1			22.5800			80.0000	1806.4000	(32b)
Internal Wall 1			72.6800			9.0000	654.1200	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7996.6800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 163.8328 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.7000	0.0500	0.1350
E4 Jamb	9.2800	0.0500	0.4640
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	13.1500	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000
E15 Flat roof with parapet	5.2500	0.5600	2.9400
P4 Party wall - Roof (insulation at ceiling level)	10.6400	0.1200	1.2768

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.1398 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 16.9859 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.1418	11.0295	10.9171	10.3554	10.2430	9.6813	9.6813	9.5689	9.9060	10.2430	10.4677	10.6924	(38)
Heat transfer coeff	28.1277	28.0153	27.9030	27.3412	27.2289	26.6671	26.6671	26.5548	26.8918	27.2289	27.4536	27.6783	(39)
Average = Sum(39)m / 12 =												27.3132	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5763	0.5740	0.5717	0.5602	0.5579	0.5463	0.5463	0.5440	0.5509	0.5579	0.5625	0.5671	(40)
HLP (average)												0.5596	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6551 (42)
Hot water usage for mixer showers

71.4595	70.3856	68.8207	65.8266	63.6170	61.1529	59.7523	61.3053	63.0077	65.6534	68.7119	71.1857	(42a)

Hot water usage for baths

22.4723	22.1385	21.6685	20.8020	20.1531	19.4336	19.0450	19.5117	20.0198	20.7897	21.6741	22.3963	(42b)

Hot water usage for other uses

31.5802	30.4318	29.2834	28.1350	26.9867	25.8383	25.8383	26.9867	28.1350	29.2834	30.4318	31.5802	(42c)

Average daily hot water use (litres/day) 115.4278 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	125.5119	122.9558	119.7726	114.7636	110.7568	106.4248	104.6356	107.8037	111.1626	115.7265	120.8177	125.1621	(44)
Energy conte	198.7801	175.0875	184.0861	157.1056	149.0999	130.8617	126.5476	133.4834	137.0746	157.0398	172.1270	195.9736	(45)
Energy content (annual)										Total = Sum(45)m =		1917.2669	
Distribution loss (46)m = 0.15 x (45)m	29.8170	26.2631	27.6129	23.5658	22.3650	19.6293	18.9821	20.0225	20.5612	23.5560	25.8191	29.3960	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
										Total per year (kWh/year) = Sum(64)m =		2164.2989	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	82.8790	73.3769	77.9933	68.4808	66.3603	59.7547	58.8617	61.1679	61.8205	69.0004	73.4754	81.9459	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.4912	15.5356	12.6344	9.5650	7.1500	6.0363	6.5224	8.4781	11.3793	14.4487	16.8637	17.9774	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.1398	217.3723	211.7465	199.7699	184.6516	170.4425	160.9500	158.7175	164.3433	176.3199	191.4382	205.6473	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	(71)

Water heating gains (Table 5)

	111.3965	109.1918	104.8296	95.1122	89.1940	82.9927	79.1152	82.2149	85.8618	92.7424	102.0492	110.1423 (72)

Total internal gains

	423.7160	421.7881	408.8990	384.1356	360.6840	339.1599	326.2761	329.0989	341.2728	363.1994	390.0395	413.4554 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.2800	11.2829	0.6300	0.8270	0.7700	25.5836	(75)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	25.5836	52.0761	93.8246	154.0869	207.1231	220.8151	206.5680	164.6784	114.3267	63.6411	32.1908	20.8928	(83)
Total gains	449.2996	473.8642	502.7235	538.2225	567.8071	559.9750	532.8441	493.7774	455.5996	426.8405	422.2303	434.3482	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.9720	79.2887	79.6080	81.2436	81.5788	83.2972	83.2972	83.6497	82.6012	81.5788	80.9111	80.2543	
alpha	6.2648	6.2859	6.3072	6.4162	6.4386	6.5531	6.5531	6.5766	6.5067	6.4386	6.3941	6.3503	
util living area	0.8808	0.8406	0.7546	0.6039	0.4446	0.3047	0.2202	0.2474	0.4066	0.6467	0.8173	0.8916	(86)
MIT	20.7391	20.8140	20.9109	20.9796	20.9972	20.9998	21.0000	21.0000	20.9989	20.9747	20.8708	20.7252	(87)
Th 2	20.4514	20.4535	20.4556	20.4660	20.4681	20.4785	20.4785	20.4806	20.4743	20.4681	20.4639	20.4597	(88)
util rest of house	0.8671	0.8240	0.7333	0.5794	0.4195	0.2799	0.1941	0.2194	0.3758	0.6173	0.7971	0.8788	(89)
MIT 2	20.1586	20.2487	20.3617	20.4461	20.4657	20.4784	20.4785	20.4806	20.4735	20.4443	20.3263	20.1498	(90)
Living area fraction									fLA = Living area / (4) =			0.5530	(91)
MIT	20.4796	20.5613	20.6654	20.7411	20.7596	20.7667	20.7669	20.7678	20.7640	20.7376	20.6274	20.4679	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.4796	20.5613	20.6654	20.7411	20.7596	20.7667	20.7669	20.7678	20.7640	20.7376	20.6274	20.4679	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8678	0.8274	0.7417	0.5921	0.4333	0.2936	0.2085	0.2349	0.3928	0.6323	0.8035	0.8790	(94)
Useful gains	389.9083	392.0794	372.8555	318.6871	246.0314	164.4113	111.1155	115.9793	178.9563	269.9043	339.2485	381.7887	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	455.0952	438.7555	395.2561	323.7494	246.6835	164.4491	111.1185	115.9858	179.2075	276.0363	371.3745	450.2689	(97)
Space heating kWh	48.4990	31.3664	16.6661	3.6449	0.4852	0.0000	0.0000	0.0000	0.0000	4.5622	23.1308	50.9493	(98a)
Space heating requirement - total per year (kWh/year)												179.3038	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	48.4990	31.3664	16.6661	3.6449	0.4852	0.0000	0.0000	0.0000	0.0000	4.5622	23.1308	50.9493	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												179.3038	
Space heating per m2										(98c) / (4) =		3.6735	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 100.0000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	48.4990	31.3664	16.6661	3.6449	0.4852	0.0000	0.0000	0.0000	0.0000	4.5622	23.1308	50.9493	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	48.4990	31.3664	16.6661	3.6449	0.4852	0.0000	0.0000	0.0000	0.0000	4.5622	23.1308	50.9493	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.4966	7.6744	8.4966	8.2225	8.4966	8.2225	8.4966	8.4966	8.2225	8.4966	8.2225	8.4966	(231)
Lighting	15.3100	12.2822	11.0588	8.1021	6.2583	5.1131	5.7091	7.4209	9.6390	12.6468	14.2846	15.7355	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.7118	-18.7024	-30.5023	-38.5410	-45.4184	-43.7828	-43.0941	-38.8073	-31.5721	-22.9240	-13.5325	-9.8625	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													

(233b)m	-2.1738	-5.1018	-11.4465	-19.2750	-27.0643	-27.8298	-27.4301	-22.1696	-15.1176	-7.9159	-3.0693	-1.6651	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	179.3038	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2164.2989	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	100.0410	(230a)
Total electricity for the above, kWh/year	100.0410	(231)
Electricity for lighting (calculated in Appendix L)	123.5603	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-518.7101	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2048.4939	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	179.3038	16.4900	29.5672	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	16.4900	356.8929	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	100.0410	16.4900	16.4968	(249)
Energy for lighting	123.5603	16.4900	20.3751	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-348.4513	16.4900	-57.4596	
PV Unit electricity exported	-170.2588	5.5900	-9.5175	
Total			-66.9771	(252)
Total energy cost			356.3549	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.3675	(257)
SAP value		77.8324	
SAP rating (Section 12)		78	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	179.3038	0.1588	28.4771	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2164.2989	0.1413	305.7097	(264)
Space and water heating			334.1868	(265)
Pumps, fans and electric keep-hot	100.0410	0.1387	13.8769	(267)
Energy for lighting	123.5603	0.1443	17.8336	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-348.4513	0.1322	-46.0791	
PV Unit electricity exported	-170.2588	0.1232	-20.9763	
Total			-67.0554	(269)
Total CO2, kg/year			298.8419	(272)
CO2 emissions per m2			6.1200	(273)
EI value			95.7313	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		48.8100 (1b)	x	2.4000 (2b)	=	117.1440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.8100						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	117.1440	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.2800	1.2357	7.7605			(27)
External Wall 1	14.1700	6.2800	7.8900	0.1400	1.1046	14.0000	110.4600	(29a)
External Roof 1	27.1000		27.1000	0.1100	2.9810	9.0000	243.9000	(30)
Total net area of external elements Aum(A, m2)			41.2700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		11.8461			(33)
Party Wall 1			24.8400	0.0000	0.0000	20.0000	496.8000	(32)
Wall to corridor			39.0100	0.0000	0.0000	20.0000	780.2000	(32)
Party Floor 1			48.8100			80.0000	3904.8000	(32d)
Party Ceiling 1			22.5800			80.0000	1806.4000	(32b)
Internal Wall 1			72.6800			9.0000	654.1200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	7996.6800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		163.8328 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.7000	0.0500	0.1350
E4 Jamb	9.2800	0.0500	0.4640
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	13.1500	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000
E15 Flat roof with parapet	5.2500	0.5600	2.9400
P4 Party wall - Roof (insulation at ceiling level)	10.6400	0.1200	1.2768

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.1398 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	16.9859 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.2542	11.2542	11.0295	10.3554	10.2430	9.7936	9.5689	9.5689	10.0183	10.5801	10.8048	10.6924	(38)
Heat transfer coeff	28.2400	28.2400	28.0153	27.3412	27.2289	26.7795	26.5548	26.5548	27.0042	27.5659	27.7906	27.6783	(39)
Average = Sum(39)m / 12 =												27.4161	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5786	0.5786	0.5740	0.5602	0.5579	0.5486	0.5440	0.5440	0.5533	0.5648	0.5694	0.5671	(40)
HLP (average)												0.5617	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.6551 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
71.4595	70.3856	68.8207	65.8266	63.6170	61.1529	59.7523	61.3053	63.0077	65.6534	68.7119	71.1857	(42a)

Hot water usage for baths

22.4723	22.1385	21.6685	20.8020	20.1531	19.4336	19.0450	19.5117	20.0198	20.7897	21.6741	22.3963	(42b)

Hot water usage for other uses

31.5802	30.4318	29.2834	28.1350	26.9867	25.8383	25.8383	26.9867	28.1350	29.2834	30.4318	31.5802	(42c)

Average daily hot water use (litres/day)	115.4278 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	125.5119	122.9558	119.7726	114.7636	110.7568	106.4248	104.6356	107.8037	111.1626	115.7265	120.8177	125.1621	(44)
Energy conte	198.7801	175.0875	184.0861	157.1056	149.0999	130.8617	126.5476	133.4834	137.0746	157.0398	172.1270	195.9736	(45)
Energy content (annual)										Total = Sum(45)m =		1917.2669	
Distribution loss (46)m = 0.15 x (45)m	29.8170	26.2631	27.6129	23.5658	22.3650	19.6293	18.9821	20.0225	20.5612	23.5560	25.8191	29.3960	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)

Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
									Total per year (kWh/year) = Sum(64)m =			2164.2989	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month													
	82.8790	73.3769	77.9933	68.4808	66.3603	59.7547	58.8617	61.1679	61.8205	69.0004	73.4754	81.9459	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	17.4912	15.5356	12.6344	9.5650	7.1500	6.0363	6.5224	8.4781	11.3793	14.4487	16.8637	17.9774	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	215.1398	217.3723	211.7465	199.7699	184.6516	170.4425	160.9500	158.7175	164.3433	176.3199	191.4382	205.6473	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	(71)
Water heating gains (Table 5)													
	111.3965	109.1918	104.8296	95.1122	89.1940	82.9927	79.1152	82.2149	85.8618	92.7424	102.0492	110.1423	(72)
Total internal gains													
	423.7160	421.7881	408.8990	384.1356	360.6840	339.1599	326.2761	329.0989	341.2728	363.1994	390.0395	413.4554	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.2800	10.0309	0.6300	0.8270	0.7700	22.7447	(75)

Solar gains	22.7447	49.2415	92.5542	160.3674	214.4517	222.8237	210.7732	162.6535	111.8389	59.7473	29.3775	19.0187	(83)
Total gains	446.4607	471.0296	501.4532	544.5030	575.1357	561.9836	537.0493	491.7525	453.1117	422.9467	419.4170	432.4741	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.6579	78.6579	79.2887	81.2436	81.5788	82.9478	83.6497	83.6497	82.2576	80.5813	79.9298	80.2543	
alpha	6.2439	6.2439	6.2859	6.4162	6.4386	6.5299	6.5766	6.5766	6.4838	6.3721	6.3287	6.3503	
util living area													
	0.8934	0.8625	0.7903	0.6418	0.4852	0.3713	0.3015	0.3346	0.4863	0.7056	0.8425	0.9038	(86)
MIT	20.7039	20.7698	20.8760	20.9691	20.9950	20.9993	20.9998	20.9997	20.9961	20.9538	20.8345	20.6890	(87)
Th 2	20.4493	20.4493	20.4535	20.4660	20.4681	20.4764	20.4806	20.4806	20.4723	20.4618	20.4577	20.4597	(88)
util rest of house													
	0.8809	0.8476	0.7710	0.6184	0.4607	0.3465	0.2759	0.3067	0.4557	0.6778	0.8241	0.8923	(89)
MIT 2	20.1144	20.1926	20.3199	20.4350	20.4635	20.4759	20.4805	20.4804	20.4690	20.4166	20.2787	20.1060	(90)
Living area fraction										fLA = Living area / (4) =		0.5530	(91)
MIT	20.4404	20.5118	20.6274	20.7303	20.7574	20.7653	20.7677	20.7676	20.7605	20.7136	20.5861	20.4284	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.4404	20.5118	20.6274	20.7303	20.7574	20.7653	20.7677	20.7676	20.7605	20.7136	20.5861	20.4284	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8806	0.8494	0.7773	0.6301	0.4740	0.3602	0.2901	0.3221	0.4724	0.6910	0.8286	0.8916	(94)
Useful gains	393.1718	400.0898	389.7623	343.0688	272.6396	202.4289	155.7829	158.4049	214.0651	292.2564	347.5219	385.5809	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	467.1010	457.8206	420.9978	350.7963	273.8518	202.5946	155.8153	158.4675	214.9666	303.6011	388.6816	463.0128	(97)
Space heating kWh													
	55.0033	38.7951	23.2392	5.5638	0.9019	0.0000	0.0000	0.0000	0.0000	8.4405	29.6350	57.6093	(98a)
Space heating requirement - total per year (kWh/year)												219.1881	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	55.0033	38.7951	23.2392	5.5638	0.9019	0.0000	0.0000	0.0000	0.0000	8.4405	29.6350	57.6093	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												219.1881	
Space heating per m2											(98c) / (4) =	4.4906	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	55.0033	38.7951	23.2392	5.5638	0.9019	0.0000	0.0000	0.0000	0.0000	8.4405	29.6350	57.6093	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	55.0033	38.7951	23.2392	5.5638	0.9019	0.0000	0.0000	0.0000	0.0000	8.4405	29.6350	57.6093	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.4966	7.6744	8.4966	8.2225	8.4966	8.2225	8.4966	8.4966	8.2225	8.4966	8.2225	8.4966	(231)
Lighting	15.3100	12.2822	11.0588	8.1021	6.2583	5.1131	5.7091	7.4209	9.6390	12.6468	14.2846	15.7355	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.6066	-18.0158	-30.5715	-40.2429	-47.0634	-44.4325	-44.1130	-38.8194	-31.3607	-21.9848	-12.5874	-9.1140	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.8386	-4.7393	-11.3630	-20.7357	-28.8710	-28.6056	-28.6545	-22.1821	-14.9388	-7.3188	-2.7000	-1.4554	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												219.1881	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2164.2989	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)													
mechanical ventilation fans (SFP = 0.7000)												100.0410	(230a)
Total electricity for the above, kWh/year												100.0410	(231)
Electricity for lighting (calculated in Appendix L)												123.5603	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-522.3147	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2084.7735	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	219.1881	25.1600	55.1477	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	25.1600	544.5376	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	100.0410	25.1600	25.1703	(249)
Energy for lighting	123.5603	25.1600	31.0878	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-348.9119	25.1600	-87.7862	
PV Unit electricity exported	-173.4029	5.8100	-10.0747	
Total			-97.8609	(252)
Total energy cost			558.0825	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	219.1881	0.1581	34.6561	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2164.2989	0.1413	305.7097	(264)
Space and water heating			340.3658	(265)
Pumps, fans and electric keep-hot	100.0410	0.1387	13.8769	(267)
Energy for lighting	123.5603	0.1443	17.8336	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-348.9119	0.1319	-46.0344	
PV Unit electricity exported	-173.4029	0.1227	-21.2739	
Total			-67.3083	(269)
Total CO2, kg/year			304.7681	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	219.1881	1.5853	347.4798	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	1.5223	3294.7406	(278)
Space and water heating			3642.2204	(279)
Pumps, fans and electric keep-hot	100.0410	1.5128	151.3420	(281)
Energy for lighting	123.5603	1.5338	189.5210	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-348.9119	1.4875	-518.9970	
PV Unit electricity exported	-173.4029	0.4502	-78.0731	
Total			-597.0701	(283)
Total Primary energy kWh/year			3386.0132	(286)

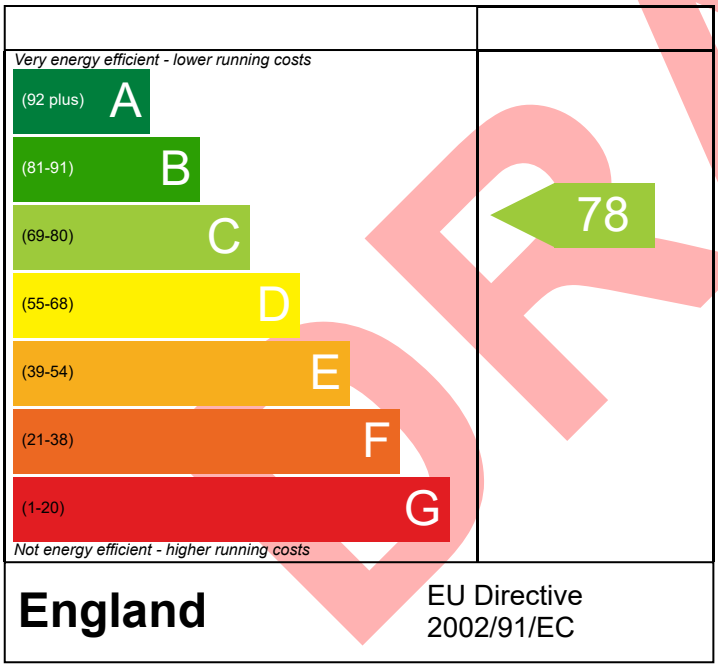
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	48.81 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

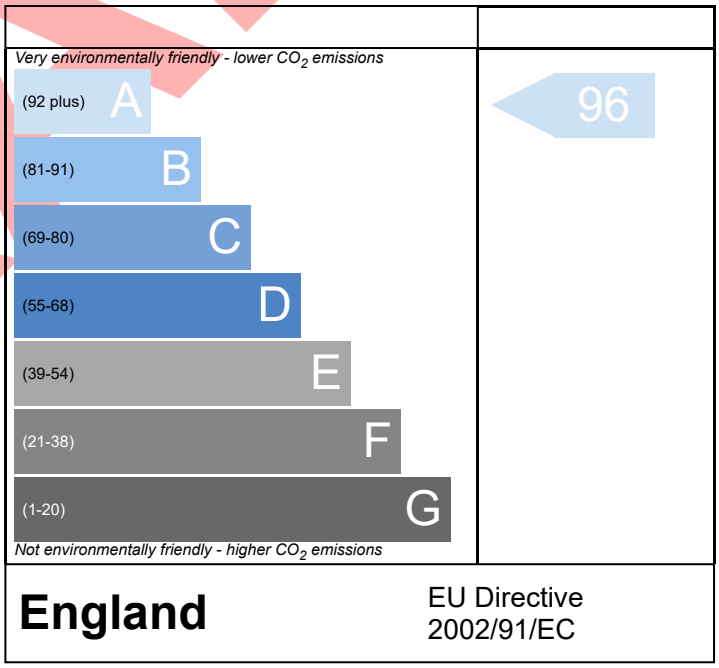
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:01

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	51 m^2
Site Reference	Unit 368 L07_Copy	Plot Reference	Unit 368 L07_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.09 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	5.38 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*60.3 kWh$_{PE}$/m^2*	
Dwelling primary energy	60.59 kWh$_{PE}$/m^2	FAIL
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*12.7 kWh/m^2*	
Dwelling fabric energy efficiency	11.8 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	7.91	0.14 **(!)**
Party wall: Party Wall (1)	47.52	0 **(!)**
Party wall: Party Wall (2)	15.79	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SE, Opening Type 1	7.88	South East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.67 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 368 L07_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 368 L07_Copy	**Prop Type Ref**	Unit 368 L07
Property			

SAP Rating	80 C	**DER**	5.38	**TER**	11.09
Environmental	96 A	**% DER < TER**			51.49
CO_2 Emissions (t/year)	0.28	**DFEE**	11.77	**TFEE**	12.71
Compliance Check	See BREL	**% DFEE < TFEE**			7.41
% DPER < TPER	-0.48	**DPER**	60.59	**TPER**	60.30

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.4800 (1b)	x	2.4000 (2b)	=	123.5520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.4800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	123.5520	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	15.7900	7.8800	7.9100	0.1400	1.1074	14.0000	110.7400	(29a)
Total net area of external elements Aum(A, m2)			15.7900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.8450			(33)
Party Wall 1			47.5200	0.0000	0.0000	20.0000	950.4000	(32)
Wall to corridor			15.7900	0.0000	0.0000	20.0000	315.8000	(32)
Party Floor 1			51.4800			80.0000	4118.4000	(32d)
Party Ceiling 1			51.4800			80.0000	4118.4000	(32b)
Internal Wall 1			80.1900			9.0000	721.7100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10335.4500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		200.7663 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695

E4 Jamb	9.2800	0.0500	0.4640	
E7 Party floor between dwellings (in blocks of flats)	5.8500	0.0700	0.4095	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.4500	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.3670 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 12.2120 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.7513	11.6328	11.5143	10.9218	10.8033	10.2109	10.2109	10.0924	10.4479	10.8033	11.0403	11.2773	(38)
Heat transfer coeff	23.9633	23.8448	23.7264	23.1339	23.0154	22.4229	22.4229	22.3044	22.6599	23.0154	23.2524	23.4894	(39)

Average = Sum(39)m / 12 = 23.1043

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4655	0.4632	0.4609	0.4494	0.4471	0.4356	0.4356	0.4333	0.4402	0.4471	0.4517	0.4563	(40)
HLP (average)												0.4488	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7337 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.2716	72.1705	70.5659	67.4959	65.2303	62.7037	61.2676	62.8600	64.6056	67.3184	70.4543	72.9909	(42a)
Hot water usage for baths	23.0390	22.6968	22.2150	21.3266	20.6614	19.9237	19.5253	20.0037	20.5247	21.3140	22.2207	22.9611	(42b)
Hot water usage for other uses	32.3851	31.2075	30.0298	28.8522	27.6746	26.4969	26.4969	27.6746	28.8522	30.0298	31.2075	32.3851	(42c)

Average daily hot water use (litres/day) 118.3558 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.6957	126.0748	122.8108	117.6747	113.5662	109.1243	107.2898	110.5383	113.9825	118.6622	123.8825	128.3371	(44)
Energy conte	203.8226	179.5288	188.7556	161.0907	152.8819	134.1811	129.7577	136.8695	140.5518	161.0235	176.4934	200.9449	(45)

Energy content (annual) Total = Sum(45)m = 1965.9015

Distribution loss (46)m = 0.15 x (45)m	30.5734	26.9293	28.3133	24.1636	22.9323	20.1272	19.4636	20.5304	21.0828	24.1535	26.4740	30.1417	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)

Total per year (kWh/year) = Sum(64)m = 2212.9335 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	84.5557	74.8537	79.5459	69.8059	67.6179	60.8584	59.9291	62.2937	62.9767	70.3250	74.9273	83.5988	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.7487	15.7643	12.8204	9.7058	7.2552	6.1252	6.6185	8.6029	11.5468	14.6613	17.1120	18.2420	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	225.4877	227.8276	221.9312	209.3786	193.5331	178.6406	168.6914	166.3516	172.2479	184.8006	200.6461	215.5386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	(71)
Water heating gains (Table 5)	113.6501	111.3894	106.9165	96.9526	90.8842	84.5256	80.5498	83.7281	87.4676	94.5228	104.0656	112.3640	(72)
Total internal gains	438.6972	436.7919	423.4788	397.8477	373.4832	351.1020	337.6704	340.4934	353.0731	375.7954	403.6344	427.9553	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(77)

Solar gains	104.6841	178.3157	243.9793	302.3022	338.6036	336.1550	324.0893	297.0068	264.1780	197.0768	125.3874	89.5877	(83)
Total gains	543.3813	615.1076	667.4580	700.1498	712.0869	687.2570	661.7597	637.5001	617.2510	572.8722	529.0217	517.5431	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	119.8063	120.4016	121.0029	124.1019	124.7408	128.0368	128.0368	128.7170	126.6977	124.7408	123.4694	122.2237	
alpha	8.9871	9.0268	9.0669	9.2735	9.3161	9.5358	9.5358	9.5811	9.4465	9.3161	9.2313	9.1482	
util living area													
	0.7234	0.6208	0.5148	0.3998	0.3006	0.2088	0.1491	0.1609	0.2533	0.4178	0.6084	0.7463	(86)
MIT	20.9795	20.9940	20.9988	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9999	20.9961	20.9757	(87)
Th 2	20.5526	20.5547	20.5568	20.5675	20.5696	20.5802	20.5802	20.5824	20.5760	20.5696	20.5653	20.5611	(88)
util rest of house													
	0.7062	0.6042	0.4992	0.3855	0.2867	0.1951	0.1349	0.1463	0.2377	0.4005	0.5899	0.7294	(89)
MIT 2	20.5313	20.5486	20.5557	20.5674	20.5696	20.5802	20.5802	20.5824	20.5760	20.5695	20.5615	20.5356	(90)
Living area fraction										fLA = Living area / (4) =		0.5577	(91)
MIT	20.7812	20.7970	20.8028	20.8086	20.8096	20.8143	20.8143	20.8153	20.8125	20.8095	20.8039	20.7811	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7812	20.7970	20.8028	20.8086	20.8096	20.8143	20.8143	20.8153	20.8125	20.8095	20.8039	20.7811	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7151	0.6132	0.5079	0.3934	0.2944	0.2028	0.1428	0.1545	0.2464	0.4101	0.6001	0.7379	(94)
Useful gains	388.5487	377.2072	338.9911	275.4626	209.6597	139.3436	94.4978	98.4804	152.1033	234.9415	317.4656	381.9023	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	394.9458	379.0622	339.3534	275.4919	209.6614	139.3436	94.4978	98.4804	152.1035	234.9759	318.6483	389.4786	(97)
Space heating kWh													
	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(98a)
Space heating requirement - total per year (kWh/year)												12.8118	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												12.8118	
Space heating per m2											(98c) / (4) =	0.2489	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9614	8.0942	8.9614	8.6723	8.9614	8.6723	8.9614	8.9614	8.6723	8.9614	8.6723	8.9614	(231)
Lighting	15.5353	12.4630	11.2216	8.2214	6.3505	5.1884	5.7931	7.5301	9.7808	12.8330	14.4948	15.9671	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.3128	-19.6230	-32.0667	-40.6524	-47.9480	-46.2189	-45.4896	-40.9865	-33.3753	-24.2196	-14.2561	-10.3736	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4545	-5.6926	-12.5456	-20.8344	-29.1368	-29.9406	-29.5123	-23.8619	-16.2788	-8.5783	-3.3998	-1.8860	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	12.8118	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2212.9335	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	105.5134	(230a)
Total electricity for the above, kWh/year	105.5134	(231)
Electricity for lighting (calculated in Appendix L)	125.3792	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-551.6441	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1904.9938	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	12.8118	16.4900	2.1127	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	16.4900	364.9127	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	105.5134	16.4900	17.3992	(249)
Energy for lighting	125.3792	16.4900	20.6750	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.5224	16.4900	-60.6044	
PV Unit electricity exported	-184.1216	5.5900	-10.2924	
Total			-70.8968	(252)
Total energy cost			334.2027	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2470	(257)
SAP value		79.7857	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	12.8118	0.1616	2.0705	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2212.9335	0.1413	312.5953	(264)
Space and water heating			314.6658	(265)
Pumps, fans and electric keep-hot	105.5134	0.1387	14.6360	(267)
Energy for lighting	125.3792	0.1443	18.0961	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.5224	0.1322	-48.5906	
PV Unit electricity exported	-184.1216	0.1235	-22.7330	
Total			-71.3237	(269)
Total CO2, kg/year			276.0743	(272)
CO2 emissions per m2			5.3600	(273)
EI value			96.1656	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		51.4800 (1b)	x	2.4000 (2b)	=	123.5520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.4800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	123.5520	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	15.7900	7.8800	7.9100	0.1400	1.1074	14.0000	110.7400	(29a)
Total net area of external elements Aum(A, m2)			15.7900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.8450			(33)
Party Wall 1			47.5200	0.0000	0.0000	20.0000	950.4000	(32)
Wall to corridor			15.7900	0.0000	0.0000	20.0000	315.8000	(32)
Party Floor 1			51.4800			80.0000	4118.4000	(32d)
Party Ceiling 1			51.4800			80.0000	4118.4000	(32b)
Internal Wall 1			80.1900			9.0000	721.7100	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 10335.4500 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 200.7663 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.8500	0.0700	0.4095
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.4500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.3670 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 12.2120 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.8698	11.8698	11.6328	10.9218	10.8033	10.3294	10.0924	10.0924	10.5664	11.1588	11.3958	11.2773	(38)
Heat transfer coeff	24.0818	24.0818	23.8448	23.1339	23.0154	22.5414	22.3044	22.3044	22.7784	23.3709	23.6079	23.4894	(39)

Average = Sum(39)m / 12 = 23.2129

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4678	0.4678	0.4632	0.4494	0.4471	0.4379	0.4333	0.4333	0.4425	0.4540	0.4586	0.4563	(40)
HLP (average)												0.4509	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7337 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.2716	72.1705	70.5659	67.4959	65.2303	62.7037	61.2676	62.8600	64.6056	67.3184	70.4543	72.9909	(42a)
Hot water usage for baths	23.0390	22.6968	22.2150	21.3266	20.6614	19.9237	19.5253	20.0037	20.5247	21.3140	22.2207	22.9611	(42b)
Hot water usage for other uses	32.3851	31.2075	30.0298	28.8522	27.6746	26.4969	26.4969	27.6746	28.8522	30.0298	31.2075	32.3851	(42c)

Average daily hot water use (litres/day) 118.3558 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.6957	126.0748	122.8108	117.6747	113.5662	109.1243	107.2898	110.5383	113.9825	118.6622	123.8825	128.3371	(44)
Energy conte	203.8226	179.5288	188.7556	161.0907	152.8819	134.1811	129.7577	136.8695	140.5518	161.0235	176.4934	200.9449	(45)
Energy content (annual)										Total = Sum(45)m =		1965.9015	
Distribution loss (46)m = 0.15 x (45)m	30.5734	26.9293	28.3133	24.1636	22.9323	20.1272	19.4636	20.5304	21.0828	24.1535	26.4740	30.1417	(46)

Water storage loss:

Store volume 143.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)

Temperature factor from Table 2b 0.6000 (49)

Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
										Total per year (kWh/year) = Sum(64)m =		2212.9335	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	84.5557	74.8537	79.5459	69.8059	67.6179	60.8584	59.9291	62.2937	62.9767	70.3250	74.9273	83.5988	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	17.7487	15.7643	12.8204	9.7058	7.2552	6.1252	6.6185	8.6029	11.5468	14.6613	17.1120	18.2420	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	225.4877	227.8276	221.9312	209.3786	193.5331	178.6406	168.6914	166.3516	172.2479	184.8006	200.6461	215.5386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	(71)
Water heating gains (Table 5)													
	113.6501	111.3894	106.9165	96.9526	90.8842	84.5256	80.5498	83.7281	87.4676	94.5228	104.0656	112.3640	(72)
Total internal gains													
	438.6972	436.7919	423.4788	397.8477	373.4832	351.1020	337.6704	340.4934	353.0731	375.7954	403.6344	427.9553	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(77)

Solar gains	95.2051	173.0844	247.4999	322.5774	357.6553	345.0938	336.8383	300.1802	265.5901	190.1488	117.1921	83.3220	(83)
Total gains	533.9023	609.8763	670.9786	720.4250	731.1385	696.1958	674.5087	640.6735	618.6632	565.9442	520.8265	511.2773	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	119.2167	119.2167	120.4016	124.1019	124.7408	127.3637	128.7170	128.7170	126.0386	122.8434	121.6103	122.2237	
alpha	8.9478	8.9478	9.0268	9.2735	9.3161	9.4909	9.5811	9.5811	9.4026	9.1896	9.1074	9.1482	
util living area													
	0.7526	0.6539	0.5462	0.4206	0.3242	0.2525	0.2017	0.2158	0.3019	0.4664	0.6480	0.7727	(86)
MIT	20.9712	20.9903	20.9979	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9996	20.9929	20.9672	(87)
Th 2	20.5504	20.5504	20.5547	20.5675	20.5696	20.5781	20.5824	20.5824	20.5738	20.5632	20.5589	20.5611	(88)
util rest of house													
	0.7357	0.6373	0.5306	0.4067	0.3107	0.2389	0.1879	0.2013	0.2862	0.4484	0.6291	0.7564	(89)
MIT 2	20.5201	20.5405	20.5526	20.5673	20.5696	20.5781	20.5824	20.5824	20.5738	20.5629	20.5519	20.5263	(90)
Living area fraction										fLA = Living area / (4) =		0.5577	(91)
MIT	20.7716	20.7914	20.8010	20.8085	20.8096	20.8134	20.8153	20.8153	20.8115	20.8064	20.7978	20.7722	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7716	20.7914	20.8010	20.8085	20.8096	20.8134	20.8153	20.8153	20.8115	20.8064	20.7978	20.7722	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7441	0.6462	0.5392	0.4144	0.3182	0.2465	0.1956	0.2094	0.2950	0.4585	0.6394	0.7643	(94)
Useful gains	397.2723	394.1170	361.8210	298.5746	232.6729	171.6165	131.9370	134.1674	182.4879	259.4584	332.9973	390.7730	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	406.3003	397.1421	362.4645	298.6242	232.6766	171.6167	131.9370	134.1674	182.4893	259.5673	335.1804	401.0157	(97)
Space heating kWh													
	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205	(98a)
Space heating requirement - total per year (kWh/year)												18.5404	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												18.5404	
Space heating per m2										(98c) / (4) =		0.3601	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9614	8.0942	8.9614	8.6723	8.9614	8.6723	8.9614	8.9614	8.6723	8.9614	8.6723	8.9614	(231)

Lighting	15.5353	12.4630	11.2216	8.2214	6.3505	5.1884	5.7931	7.5301	9.7808	12.8330	14.4948	15.9671 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-11.1496	-18.8721	-32.0603	-42.3899	-49.6609	-46.9012	-46.5595	-40.9992	-33.1527	-23.1943	-13.2464	-9.5840 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.0858	-5.3278	-12.5367	-22.4603	-31.0947	-30.7742	-30.8282	-23.8754	-16.0865	-7.9699	-3.0116	-1.6564 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	18.5404 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2212.9335 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	105.5134 (230a)
Total electricity for the above, kWh/year	105.5134 (231)
Electricity for lighting (calculated in Appendix L)	125.3792 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-555.4776 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1906.8888 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	18.5404	25.1600	4.6648	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	25.1600	556.7741	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	105.5134	25.1600	26.5472	(249)
Energy for lighting	125.3792	25.1600	31.5454	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.7700	25.1600	-92.5309	
PV Unit electricity exported	-187.7076	5.8100	-10.9058	
Total			-103.4367	(252)
Total energy cost			516.0946	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	18.5404	0.1612	2.9893	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2212.9335	0.1413	312.5953	(264)
Space and water heating			315.5847	(265)
Pumps, fans and electric keep-hot	105.5134	0.1387	14.6360	(267)
Energy for lighting	125.3792	0.1443	18.0961	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.7700	0.1319	-48.5087	
PV Unit electricity exported	-187.7076	0.1230	-23.0860	
Total			-71.5947	(269)
Total CO2, kg/year			276.7220	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	18.5404	1.5966	29.6024	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	1.5223	3368.8373	(278)
Space and water heating			3398.4396	(279)
Pumps, fans and electric keep-hot	105.5134	1.5128	159.6207	(281)
Energy for lighting	125.3792	1.5338	192.3107	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.7700	1.4873	-546.9961	
PV Unit electricity exported	-187.7076	0.4514	-84.7250	
Total			-631.7212	(283)
Total Primary energy kWh/year			3118.6499	(286)

SAP 10 EPC IMPROVEMENTS

Unit 368 L07_Copy

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 80
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£620	£620	£0
Space heating	£31	£31	£0
Water heating	£557	£557	£0
Lighting	£32	£32	£0
Generated (PV)	-£103	-£103	£0
Total cost of fuels	£517	£517	£0
Total cost of uses	£517	£517	£0
Delivered energy	37 kWh/m²	37 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	61 kWh/m²	61 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.4800 (1b)	x	2.4000 (2b)	=	123.5520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.4800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	123.5520	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	15.7900	7.8800	7.9100	0.1400	1.1074	14.0000	110.7400	(29a)
Total net area of external elements Aum(A, m2)			15.7900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	10.8450			(33)
Party Wall 1			47.5200	0.0000	0.0000	20.0000	950.4000	(32)
Wall to corridor			15.7900	0.0000	0.0000	20.0000	315.8000	(32)
Party Floor 1			51.4800			80.0000	4118.4000	(32d)
Party Ceiling 1			51.4800			80.0000	4118.4000	(32b)
Internal Wall 1			80.1900			9.0000	721.7100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10335.4500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		200.7663 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.8500	0.0700	0.4095
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.4500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.3670 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	12.2120 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.7513	11.6328	11.5143	10.9218	10.8033	10.2109	10.2109	10.0924	10.4479	10.8033	11.0403	11.2773	(38)
Heat transfer coeff	23.9633	23.8448	23.7264	23.1339	23.0154	22.4229	22.4229	22.3044	22.6599	23.0154	23.2524	23.4894	(39)
Average = Sum(39)m / 12 =												23.1043	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4655	0.4632	0.4609	0.4494	0.4471	0.4356	0.4356	0.4333	0.4402	0.4471	0.4517	0.4563	(40)
HLP (average)												0.4488	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7337	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.2716	72.1705	70.5659	67.4959	65.2303	62.7037	61.2676	62.8600	64.6056	67.3184	70.4543	72.9909	(42a)

Hot water usage for baths

23.0390	22.6968	22.2150	21.3266	20.6614	19.9237	19.5253	20.0037	20.5247	21.3140	22.2207	22.9611	(42b)

Hot water usage for other uses

32.3851	31.2075	30.0298	28.8522	27.6746	26.4969	26.4969	27.6746	28.8522	30.0298	31.2075	32.3851	(42c)

Average daily hot water use (litres/day)	118.3558	(43)

Daily hot water use

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
128.6957	126.0748	122.8108	117.6747	113.5662	109.1243	107.2898	110.5383	113.9825	118.6622	123.8825	128.3371	(44)
Energy conte 203.8226	179.5288	188.7556	161.0907	152.8819	134.1811	129.7577	136.8695	140.5518	161.0235	176.4934	200.9449	(45)

Energy content (annual)	Total = Sum(45)m =	1965.9015

Distribution loss (46)m = 0.15 x (45)m

30.5734	26.9293	28.3133	24.1636	22.9323	20.1272	19.4636	20.5304	21.0828	24.1535	26.4740	30.1417	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)

Total per year (kWh/year) = Sum(64)m =	2212.9335	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000	(64a)

Heat gains from water heating, kWh/month

84.5557	74.8537	79.5459	69.8059	67.6179	60.8584	59.9291	62.2937	62.9767	70.3250	74.9273	83.5988	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.7487	15.7643	12.8204	9.7058	7.2552	6.1252	6.6185	8.6029	11.5468	14.6613	17.1120	18.2420	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	225.4877	227.8276	221.9312	209.3786	193.5331	178.6406	168.6914	166.3516	172.2479	184.8006	200.6461	215.5386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	(71)
Water heating gains (Table 5)	113.6501	111.3894	106.9165	96.9526	90.8842	84.5256	80.5498	83.7281	87.4676	94.5228	104.0656	112.3640	(72)
Total internal gains	438.6972	436.7919	423.4788	397.8477	373.4832	351.1020	337.6704	340.4934	353.0731	375.7954	403.6344	427.9553	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(77)

Solar gains	104.6841	178.3157	243.9793	302.3022	338.6036	336.1550	324.0893	297.0068	264.1780	197.0768	125.3874	89.5877 (83)
Total gains	543.3813	615.1076	667.4580	700.1498	712.0869	687.2570	661.7597	637.5001	617.2510	572.8722	529.0217	517.5431 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	119.8063	120.4016	121.0029	124.1019	124.7408	128.0368	128.0368	128.7170	126.6977	124.7408	123.4694	122.2237	
alpha	8.9871	9.0268	9.0669	9.2735	9.3161	9.5358	9.5358	9.5811	9.4465	9.3161	9.2313	9.1482	
util living area	0.7234	0.6208	0.5148	0.3998	0.3006	0.2088	0.1491	0.1609	0.2533	0.4178	0.6084	0.7463	(86)
MIT	20.9795	20.9940	20.9988	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9999	20.9961	20.9757	(87)
Th 2	20.5526	20.5547	20.5568	20.5675	20.5696	20.5802	20.5802	20.5824	20.5760	20.5696	20.5653	20.5611	(88)
util rest of house	0.7062	0.6042	0.4992	0.3855	0.2867	0.1951	0.1349	0.1463	0.2377	0.4005	0.5899	0.7294	(89)
MIT 2	20.5313	20.5486	20.5557	20.5674	20.5696	20.5802	20.5802	20.5824	20.5760	20.5695	20.5615	20.5356	(90)
Living area fraction									fLA = Living area / (4) =			0.5577	(91)
MIT	20.7812	20.7970	20.8028	20.8086	20.8096	20.8143	20.8143	20.8153	20.8125	20.8095	20.8039	20.7811	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7812	20.7970	20.8028	20.8086	20.8096	20.8143	20.8143	20.8153	20.8125	20.8095	20.8039	20.7811	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7151	0.6132	0.5079	0.3934	0.2944	0.2028	0.1428	0.1545	0.2464	0.4101	0.6001	0.7379	(94)
Useful gains	388.5487	377.2072	338.9911	275.4626	209.6597	139.3436	94.4978	98.4804	152.1033	234.9415	317.4656	381.9023	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	394.9458	379.0622	339.3534	275.4919	209.6614	139.3436	94.4978	98.4804	152.1035	234.9759	318.6483	389.4786	(97)
Space heating kWh	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(98a)
Space heating requirement - total per year (kWh/year)												12.8118	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												12.8118	
Space heating per m2											(98c) / (4) =	0.2489	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9614	8.0942	8.9614	8.6723	8.9614	8.6723	8.9614	8.9614	8.6723	8.9614	8.6723	8.9614	(231)
Lighting	15.5353	12.4630	11.2216	8.2214	6.3505	5.1884	5.7931	7.5301	9.7808	12.8330	14.4948	15.9671	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.3128	-19.6230	-32.0667	-40.6524	-47.9480	-46.2189	-45.4896	-40.9865	-33.3753	-24.2196	-14.2561	-10.3736	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4545	-5.6926	-12.5456	-20.8344	-29.1368	-29.9406	-29.5123	-23.8619	-16.2788	-8.5783	-3.3998	-1.8860	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												12.8118	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2212.9335	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	105.5134	(230a)
Total electricity for the above, kWh/year	105.5134	(231)
Electricity for lighting (calculated in Appendix L)	125.3792	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-551.6441	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1904.9938	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	12.8118	16.4900	2.1127	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	16.4900	364.9127	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	105.5134	16.4900	17.3992	(249)
Energy for lighting	125.3792	16.4900	20.6750	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.5224	16.4900	-60.6044	
PV Unit electricity exported	-184.1216	5.5900	-10.2924	
Total			-70.8968	(252)
Total energy cost			334.2027	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2470	(257)
SAP value	79.7857	
SAP rating (Section 12)	80	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	12.8118	0.1616	2.0705	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2212.9335	0.1413	312.5953	(264)
Space and water heating			314.6658	(265)
Pumps, fans and electric keep-hot	105.5134	0.1387	14.6360	(267)
Energy for lighting	125.3792	0.1443	18.0961	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.5224	0.1322	-48.5906	
PV Unit electricity exported	-184.1216	0.1235	-22.7330	
Total			-71.3237	(269)
Total CO2, kg/year			276.0743	(272)
CO2 emissions per m2			5.3600	(273)
EI value			96.1656	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.4800	(1b)	x 2.4000	(2b) =	123.5520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 51.4800						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		123.5520	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 = 0.0000	(6a)
Number of open flues	0 * 20 = 0.0000	(6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	15.7900	7.8800	7.9100	0.1400	1.1074	14.0000	110.7400	(29a)
Total net area of external elements Aum(A, m2)			15.7900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	10.8450			(33)
Party Wall 1			47.5200	0.0000	0.0000	20.0000	950.4000	(32)
Wall to corridor			15.7900	0.0000	0.0000	20.0000	315.8000	(32)
Party Floor 1			51.4800			80.0000	4118.4000	(32d)
Party Ceiling 1			51.4800			80.0000	4118.4000	(32b)
Internal Wall 1			80.1900			9.0000	721.7100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10335.4500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		200.7663 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.8500	0.0700	0.4095
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.4500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.3670 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	12.2120 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.8698	11.8698	11.6328	10.9218	10.8033	10.3294	10.0924	10.0924	10.5664	11.1588	11.3958	11.2773	(38)
Heat transfer coeff	24.0818	24.0818	23.8448	23.1339	23.0154	22.5414	22.3044	22.3044	22.7784	23.3709	23.6079	23.4894	(39)
Average = Sum(39)m / 12 =												23.2129	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4678	0.4678	0.4632	0.4494	0.4471	0.4379	0.4333	0.4333	0.4425	0.4540	0.4586	0.4563	(40)
HLP (average)												0.4509	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.7337 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.2716	72.1705	70.5659	67.4959	65.2303	62.7037	61.2676	62.8600	64.6056	67.3184	70.4543	72.9909	(42a)

Hot water usage for baths

23.0390	22.6968	22.2150	21.3266	20.6614	19.9237	19.5253	20.0037	20.5247	21.3140	22.2207	22.9611	(42b)

Hot water usage for other uses

32.3851	31.2075	30.0298	28.8522	27.6746	26.4969	26.4969	27.6746	28.8522	30.0298	31.2075	32.3851	(42c)

Average daily hot water use (litres/day)		118.3558 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.6957	126.0748	122.8108	117.6747	113.5662	109.1243	107.2898	110.5383	113.9825	118.6622	123.8825	128.3371	(44)
Energy conte	203.8226	179.5288	188.7556	161.0907	152.8819	134.1811	129.7577	136.8695	140.5518	161.0235	176.4934	200.9449	(45)
Energy content (annual)										Total = Sum(45)m =		1965.9015	

Distribution loss (46)m = 0.15 x (45)m

30.5734	26.9293	28.3133	24.1636	22.9323	20.1272	19.4636	20.5304	21.0828	24.1535	26.4740	30.1417	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
										Total per year (kWh/year) = Sum(64)m =		2212.9335	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	84.5557	74.8537	79.5459	69.8059	67.6179	60.8584	59.9291	62.2937	62.9767	70.3250	74.9273	83.5988	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.7487	15.7643	12.8204	9.7058	7.2552	6.1252	6.6185	8.6029	11.5468	14.6613	17.1120	18.2420	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	225.4877	227.8276	221.9312	209.3786	193.5331	178.6406	168.6914	166.3516	172.2479	184.8006	200.6461	215.5386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	(71)
Water heating gains (Table 5)	113.6501	111.3894	106.9165	96.9526	90.8842	84.5256	80.5498	83.7281	87.4676	94.5228	104.0656	112.3640	(72)
Total internal gains	438.6972	436.7919	423.4788	397.8477	373.4832	351.1020	337.6704	340.4934	353.0731	375.7954	403.6344	427.9553	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(77)

Solar gains	95.2051	173.0844	247.4999	322.5774	357.6553	345.0938	336.8383	300.1802	265.5901	190.1488	117.1921	83.3220	(83)
Total gains	533.9023	609.8763	670.9786	720.4250	731.1385	696.1958	674.5087	640.6735	618.6632	565.9442	520.8265	511.2773	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	119.2167	119.2167	120.4016	124.1019	124.7408	127.3637	128.7170	128.7170	126.0386	122.8434	121.6103	122.2237	
alpha	8.9478	8.9478	9.0268	9.2735	9.3161	9.4909	9.5811	9.5811	9.4026	9.1896	9.1074	9.1482	
util living area	0.7526	0.6539	0.5462	0.4206	0.3242	0.2525	0.2017	0.2158	0.3019	0.4664	0.6480	0.7727	(86)
MIT	20.9712	20.9903	20.9979	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9996	20.9929	20.9672	(87)
Th 2	20.5504	20.5504	20.5547	20.5675	20.5696	20.5781	20.5824	20.5824	20.5738	20.5632	20.5589	20.5611	(88)
util rest of house	0.7357	0.6373	0.5306	0.4067	0.3107	0.2389	0.1879	0.2013	0.2862	0.4484	0.6291	0.7564	(89)
MIT 2	20.5201	20.5405	20.5526	20.5673	20.5696	20.5781	20.5824	20.5824	20.5738	20.5629	20.5519	20.5263	(90)
Living area fraction										fLA = Living area / (4) =		0.5577	(91)
MIT	20.7716	20.7914	20.8010	20.8085	20.8096	20.8134	20.8153	20.8153	20.8115	20.8064	20.7978	20.7722	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7716	20.7914	20.8010	20.8085	20.8096	20.8134	20.8153	20.8153	20.8115	20.8064	20.7978	20.7722	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7441	0.6462	0.5392	0.4144	0.3182	0.2465	0.1956	0.2094	0.2950	0.4585	0.6394	0.7643	(94)
Useful gains	397.2723	394.1170	361.8210	298.5746	232.6729	171.6165	131.9370	134.1674	182.4879	259.4584	332.9973	390.7730	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	406.3003	397.1421	362.4645	298.6242	232.6766	171.6167	131.9370	134.1674	182.4893	259.5673	335.1804	401.0157	(97)
Space heating kWh	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205	(98a)
Space heating requirement - total per year (kWh/year)												18.5404	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												18.5404	
Space heating per m2											(98c) / (4) =	0.3601	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													

	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	8.9614	8.0942	8.9614	8.6723	8.9614	8.6723	8.9614	8.9614	8.6723	8.9614	8.6723	8.9614 (231)
Lighting	15.5353	12.4630	11.2216	8.2214	6.3505	5.1884	5.7931	7.5301	9.7808	12.8330	14.4948	15.9671 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-11.1496	-18.8721	-32.0603	-42.3899	-49.6609	-46.9012	-46.5595	-40.9992	-33.1527	-23.1943	-13.2464	-9.5840 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.0858	-5.3278	-12.5367	-22.4603	-31.0947	-30.7742	-30.8282	-23.8754	-16.0865	-7.9699	-3.0116	-1.6564 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	18.5404 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2212.9335 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	105.5134 (230a)
Total electricity for the above, kWh/year	105.5134 (231)
Electricity for lighting (calculated in Appendix L)	125.3792 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-555.4776 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1906.8888 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	18.5404	25.1600	4.6648	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	25.1600	556.7741	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	105.5134	25.1600	26.5472	(249)
Energy for lighting	125.3792	25.1600	31.5454	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.7700	25.1600	-92.5309	
PV Unit electricity exported	-187.7076	5.8100	-10.9058	
Total			-103.4367	(252)
Total energy cost			516.0946	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	18.5404	0.1612	2.9893	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2212.9335	0.1413	312.5953	(264)
Space and water heating			315.5847	(265)
Pumps, fans and electric keep-hot	105.5134	0.1387	14.6360	(267)
Energy for lighting	125.3792	0.1443	18.0961	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.7700	0.1319	-48.5087	
PV Unit electricity exported	-187.7076	0.1230	-23.0860	
Total			-71.5947	(269)
Total CO2, kg/year			276.7220	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	18.5404	1.5966	29.6024	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	1.5223	3368.8373	(278)
Space and water heating			3398.4396	(279)

Pumps, fans and electric keep-hot	105.5134	1.5128	159.6207 (281)
Energy for lighting	125.3792	1.5338	192.3107 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-367.7700	1.4873	-546.9961
PV Unit electricity exported	-187.7076	0.4514	-84.7250
Total			-631.7212 (283)
Total Primary energy kWh/year			3118.6499 (286)

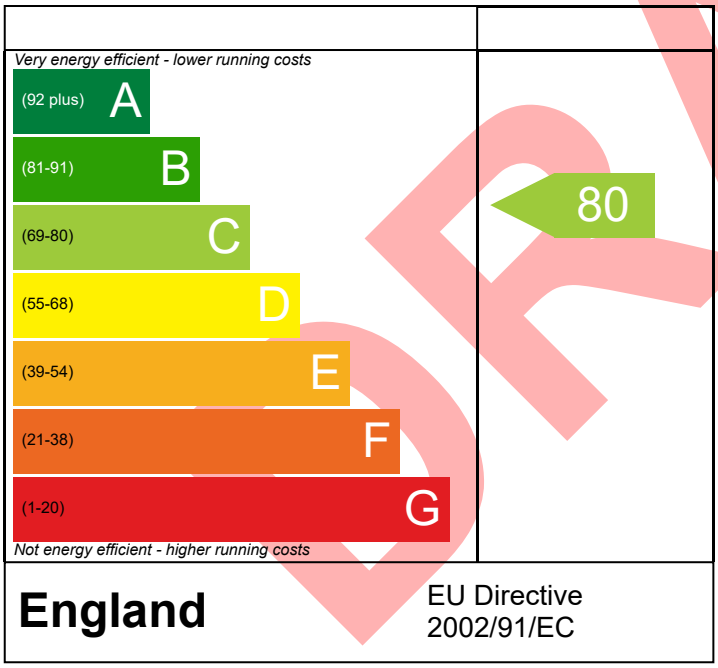
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	51.48 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

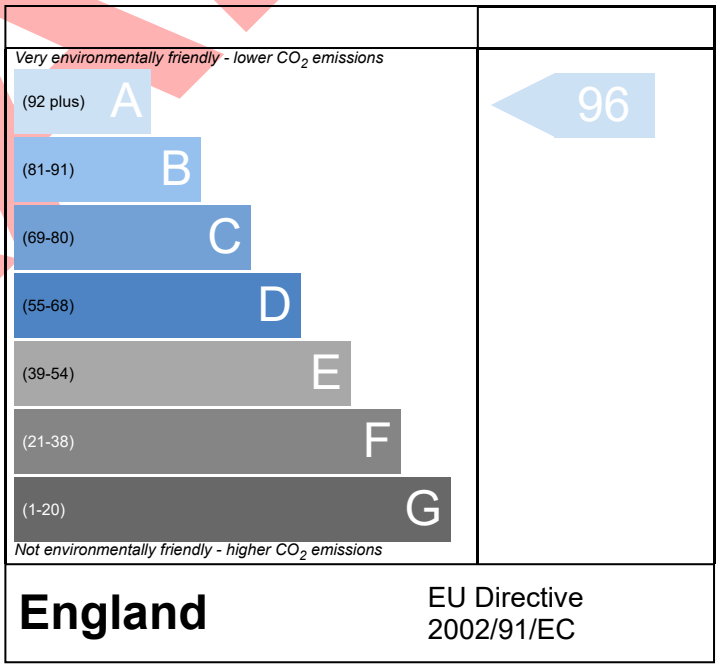
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:02

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	66 m^2
Site Reference	Unit 369 L07_Copy	Plot Reference	Unit 369 L07_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*12.09 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	5.9 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*65.26 kWh_{PE}/m^2*	
Dwelling primary energy	65.22 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*25.4 kWh/m^2*	
Dwelling fabric energy efficiency	26.2 kWh/m^2	FAIL

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	21.88	0.14 **(!)**
Party wall: Party Wall (1)	30.24	0 **(!)**
Party wall: Party Wall (2)	14.18	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	7.88	North East	0.83	1.3
N, Opening Type 1	3.59	North	0.83	1.3
NW, Opening Type 1	7.88	North West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.85 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 369 L07_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 369 L07_Copy	**Prop Type Ref**	Unit 369 L07
Property			

SAP Rating	77 C	**DER**	5.90	**TER**	12.09
Environmental	95 A	**% DER < TER**			51.20
CO_2 Emissions (t/year)	0.39	**DFEE**	26.20	**TFEE**	25.40
Compliance Check	See BREL	**% DFEE < TFEE**			-3.16
% DPER < TPER	0.06	**DPER**	65.22	**TPER**	65.26

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		65.6000 (1b)	x	2.4000 (2b)	=	157.4400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.6000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	157.4400	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.3500	1.2357	23.9116			(27)
External Wall 1	41.2300	19.3500	21.8800	0.1400	3.0632	14.0000	306.3200	(29a)
Total net area of external elements Aum(A, m2)			41.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.9748			(33)
Party Wall 1			30.2400	0.0000	0.0000	20.0000	604.8000	(32)
Wall to corridor			14.1800	0.0000	0.0000	20.0000	283.6000	(32)
Party Floor 1			65.6000			80.0000	5248.0000	(32d)
Party Ceiling 1			65.6000			80.0000	5248.0000	(32b)
Internal Wall 1			114.4800			9.0000	1030.3200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12721.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		193.9183 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240

E4 Jamb	23.2000	0.0500	1.1600	
E7 Party floor between dwellings (in blocks of flats)	15.2700	0.0700	1.0689	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.4500	0.0000	0.0000	
E16 Corner (normal)	5.4000	0.0900	0.4860	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.4629 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 30.4377 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.7197	15.5541	15.3885	14.5604	14.3948	13.5668	13.5668	13.4012	13.8980	14.3948	14.7261	15.0573	(38)
Heat transfer coeff	46.1574	45.9918	45.8262	44.9981	44.8325	44.0045	44.0045	43.8389	44.3357	44.8325	45.1637	45.4950	(39)
Average = Sum(39)m / 12 =												44.9567	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7036	0.7011	0.6986	0.6859	0.6834	0.6708	0.6708	0.6683	0.6758	0.6834	0.6885	0.6935	(40)
HLP (average)												0.6853	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1348 (42)
Hot water usage for mixer showers

82.5173	81.2772	79.4702	76.0128	73.4613	70.6159	68.9985	70.7919	72.7577	75.8128	79.3445	82.2011	(42a)

Hot water usage for baths

25.9306	25.5455	25.0032	24.0033	23.2545	22.4243	21.9759	22.5144	23.1007	23.9891	25.0096	25.8429	(42b)

Hot water usage for other uses

36.4921	35.1651	33.8381	32.5112	31.1842	29.8572	29.8572	31.1842	32.5112	33.8381	35.1651	36.4921	(42c)

Average daily hot water use (litres/day) 133.2946 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.9400	141.9879	138.3115	132.5272	127.9000	122.8974	120.8316	124.4905	128.3696	133.6401	139.5193	144.5362	(44)
Energy conte	229.5496	202.1888	212.5797	181.4231	172.1780	151.1167	146.1353	154.1452	158.2926	181.3483	198.7708	226.3088	(45)
Energy content (annual)										Total = Sum(45)m =		2214.0368	

Distribution loss (46)m = 0.15 x (45)m

34.4324	30.3283	31.8870	27.2135	25.8267	22.6675	21.9203	23.1218	23.7439	27.2023	29.8156	33.9463	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)

Total per year (kWh/year) = Sum(64)m = 2461.0688 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

93.1099	82.3881	87.4674	76.5664	74.0338	66.4895	65.3746	68.0379	68.8755	77.0830	82.3345	92.0323	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.5047	19.1002	15.5334	11.7598	8.7906	7.4214	8.0190	10.4234	13.9903	17.7639	20.7331	22.1023	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	278.8333	281.7267	274.4354	258.9131	239.3189	220.9031	208.6002	205.7068	212.9981	228.5205	248.1147	266.5304	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(70)
Losses e.g. evaporation (negative values) (Table 5)	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	(71)
Water heating gains (Table 5)	125.1477	122.6013	117.5637	106.3422	99.5078	92.3465	87.8691	91.4488	95.6604	103.6061	114.3535	123.6993	(72)
Total internal gains	518.1243	516.0669	500.1711	469.6536	440.2559	413.3096	397.1270	400.2177	415.2875	442.5292	475.8399	504.9707	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5900	10.6334	0.6300	0.8270	0.7700	13.7831	(74)
Northeast	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(75)
Northwest	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(81)

Solar gains 77.9864	157.0279	280.2162	458.5828	616.6334	657.8250	615.1898	490.0648	340.7231	191.0654	97.7876	63.9219	(83)
Total gains 596.1107	673.0949	780.3873	928.2365	1056.8893	1071.1345	1012.3168	890.2825	756.0106	633.5945	573.6275	568.8927	(84)

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7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
tau	76.5559	76.8316	77.1093	78.5282	78.8183	80.3014	80.3014	80.6047	79.7015	78.8183	78.2402	77.6706	
alpha	6.1037	6.1221	6.1406	6.2352	6.2546	6.3534	6.3534	6.3736	6.3134	6.2546	6.2160	6.1780	
util living area	0.9437	0.8971	0.7825	0.5777	0.3938	0.2629	0.1913	0.2265	0.4038	0.7039	0.8971	0.9531	(86)
MIT	20.5409	20.6986	20.8811	20.9817	20.9983	20.9999	21.0000	21.0000	20.9987	20.9551	20.7496	20.5092	(87)
Th 2	20.3376	20.3399	20.3421	20.3533	20.3555	20.3667	20.3667	20.3689	20.3622	20.3555	20.3510	20.3466	(88)
util rest of house	0.9339	0.8815	0.7577	0.5488	0.3667	0.2369	0.1637	0.1954	0.3668	0.6677	0.8790	0.9447	(89)
MIT 2	19.8185	20.0094	20.2201	20.3364	20.3542	20.3666	20.3667	20.3689	20.3613	20.3148	20.0834	19.7875	(90)
Living area fraction										fLA = Living area / (4) =		0.4663	(91)
MIT	20.1554	20.3308	20.5284	20.6373	20.6546	20.6619	20.6620	20.6632	20.6585	20.6134	20.3941	20.1241	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1554	20.3308	20.5284	20.6373	20.6546	20.6619	20.6620	20.6632	20.6585	20.6134	20.3941	20.1241	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9309	0.8813	0.7649	0.5616	0.3793	0.2490	0.1766	0.2099	0.3841	0.6825	0.8803	0.9414	(94)
Useful gains	554.9067	593.1911	596.9001	521.2762	400.8703	266.7233	178.7442	186.8865	290.3468	432.4035	504.9500	535.5811	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	731.8424	709.6904	642.8668	528.1577	401.4553	266.7525	178.7466	186.8936	290.7766	448.9253	600.4104	724.4643	(97)
Space heating kWh	131.6402	78.2875	34.1992	4.9547	0.4352	0.0000	0.0000	0.0000	0.0000	12.2922	68.7315	140.5291	(98a)
Space heating requirement - total per year (kWh/year)												471.0696	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	131.6402	78.2875	34.1992	4.9547	0.4352	0.0000	0.0000	0.0000	0.0000	12.2922	68.7315	140.5291	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												471.0696	
Space heating per m2											(98c) / (4) =	7.1809	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	131.6402	78.2875	34.1992	4.9547	0.4352	0.0000	0.0000	0.0000	0.0000	12.2922	68.7315	140.5291	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	131.6402	78.2875	34.1992	4.9547	0.4352	0.0000	0.0000	0.0000	0.0000	12.2922	68.7315	140.5291	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	12.1045	10.9331	12.1045	11.7141	12.1045	11.7141	12.1045	12.1045	11.7141	12.1045	11.7141	12.1045	(231)
Lighting	18.8229	15.1004	13.5963	9.9612	7.6943	6.2863	7.0190	9.1236	11.8506	15.5487	17.5622	19.3460	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.8151	-25.1332	-40.5864	-50.8024	-59.6183	-57.3843	-56.4723	-50.9617	-41.6122	-30.4646	-18.2004	-13.3279	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.9195	-6.9836	-16.0113	-27.2032	-38.1758	-39.2360	-38.6794	-31.3088	-21.3818	-11.1448	-4.1988	-2.2253	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	471.0696	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2461.0688	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	142.5210	(230a)
Total electricity for the above, kWh/year	142.5210	(231)
Electricity for lighting (calculated in Appendix L)	151.9116	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-699.8470	(233)
Wind generation	0.0000	(234)

Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2526.7240	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	471.0696	16.4900	77.6794	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	16.4900	405.8302	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	142.5210	16.4900	23.5017	(249)
Energy for lighting	151.9116	16.4900	25.0502	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.3787	16.4900	-75.9165	
PV Unit electricity exported	-239.4682	5.5900	-13.3863	
Total			-89.3027	(252)
Total energy cost			442.7588	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.4412	(257)
SAP value	76.6387	
SAP rating (Section 12)	77	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	471.0696	0.1591	74.9382	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2461.0688	0.1413	347.7259	(264)
Space and water heating			422.6642	(265)
Pumps, fans and electric keep-hot	142.5210	0.1387	19.7694	(267)
Energy for lighting	151.9116	0.1443	21.9255	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.3787	0.1324	-60.9461	
PV Unit electricity exported	-239.4682	0.1230	-29.4551	
Total			-90.4011	(269)
Total CO2, kg/year			373.9580	(272)
CO2 emissions per m2			5.7000	(273)
EI value			95.4692	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.6000 (1b)	x	2.4000 (2b)	=	157.4400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	157.4400	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.3500	1.2357	23.9116			(27)
External Wall 1	41.2300	19.3500	21.8800	0.1400	3.0632	14.0000	306.3200	(29a)
Total net area of external elements Aum(A, m2)			41.2300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.9748			(33)
Party Wall 1			30.2400	0.0000	0.0000	20.0000	604.8000	(32)
Wall to corridor			14.1800	0.0000	0.0000	20.0000	283.6000	(32)
Party Floor 1			65.6000			80.0000	5248.0000	(32d)
Party Ceiling 1			65.6000			80.0000	5248.0000	(32b)
Internal Wall 1			114.4800			9.0000	1030.3200	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12721.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 193.9183 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	15.2700	0.0700	1.0689
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.4500	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.4629 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 30.4377 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.8853	15.8853	15.5541	14.5604	14.3948	13.7324	13.4012	13.4012	14.0636	14.8917	15.2229	15.0573	(38)
Heat transfer coeff	46.3230	46.3230	45.9918	44.9981	44.8325	44.1701	43.8389	43.8389	44.5013	45.3294	45.6606	45.4950	(39)

Average = Sum(39)m / 12 = 45.1085

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7061	0.7061	0.7011	0.6859	0.6834	0.6733	0.6683	0.6683	0.6784	0.6910	0.6960	0.6935	(40)
HLP (average)												0.6876	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1348 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	82.5173	81.2772	79.4702	76.0128	73.4613	70.6159	68.9985	70.7919	72.7577	75.8128	79.3445	82.2011	(42a)
Hot water usage for baths	25.9306	25.5455	25.0032	24.0033	23.2545	22.4243	21.9759	22.5144	23.1007	23.9891	25.0096	25.8429	(42b)
Hot water usage for other uses	36.4921	35.1651	33.8381	32.5112	31.1842	29.8572	29.8572	31.1842	32.5112	33.8381	35.1651	36.4921	(42c)

Average daily hot water use (litres/day) 133.2946 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.9400	141.9879	138.3115	132.5272	127.9000	122.8974	120.8316	124.4905	128.3696	133.6401	139.5193	144.5362	(44)
Energy conte	229.5496	202.1888	212.5797	181.4231	172.1780	151.1167	146.1353	154.1452	158.2926	181.3483	198.7708	226.3088	(45)

Energy content (annual) Total = Sum(45)m = 2214.0368
Distribution loss (46)m = 0.15 x (45)m

	34.4324	30.3283	31.8870	27.2135	25.8267	22.6675	21.9203	23.1218	23.7439	27.2023	29.8156	33.9463	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)

Total per year (kWh/year) = Sum(64)m = 2461.0688 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

	93.1099	82.3881	87.4674	76.5664	74.0338	66.4895	65.3746	68.0379	68.8755	77.0830	82.3345	92.0323	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	21.5047	19.1002	15.5334	11.7598	8.7906	7.4214	8.0190	10.4234	13.9903	17.7639	20.7331	22.1023	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	278.8333	281.7267	274.4354	258.9131	239.3189	220.9031	208.6002	205.7068	212.9981	228.5205	248.1147	266.5304	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	(71)

Water heating gains (Table 5)

	125.1477	122.6013	117.5637	106.3422	99.5078	92.3465	87.8691	91.4488	95.6604	103.6061	114.3535	123.6993	(72)

Total internal gains

	518.1243	516.0669	500.1711	469.6536	440.2559	413.3096	397.1270	400.2177	415.2875	442.5292	475.8399	504.9707	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5900	9.5462	0.6300	0.8270	0.7700	12.3738	(74)
Northeast	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(75)
Northwest	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(81)

Solar gains	69.4528	148.6778	276.6041	477.3240	638.3689	663.6861	627.6104	484.0300	333.4428	179.5688	89.3871	58.2939	(83)
Total gains	587.5771	664.7447	776.7752	946.9776	1078.6248	1076.9957	1024.7374	884.2477	748.7303	622.0980	565.2270	563.2647	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.2822	76.2822	76.8316	78.5282	78.8183	80.0003	80.6047	80.6047	79.4049	77.9544	77.3889	77.6706	
alpha	6.0855	6.0855	6.1221	6.2352	6.2546	6.3334	6.3736	6.3736	6.2937	6.1970	6.1593	6.1780	
util living area	0.9523	0.9151	0.8170	0.6098	0.4269	0.3197	0.2609	0.3073	0.4846	0.7655	0.9164	0.9604	(86)
MIT	20.4877	20.6359	20.8375	20.9735	20.9971	20.9996	20.9999	20.9998	20.9955	20.9203	20.6918	20.4562	(87)
Th 2	20.3354	20.3354	20.3399	20.3533	20.3555	20.3645	20.3689	20.3689	20.3600	20.3488	20.3443	20.3466	(88)
util rest of house	0.9439	0.9018	0.7950	0.5824	0.4005	0.2937	0.2339	0.2760	0.4477	0.7329	0.9011	0.9533	(89)
MIT 2	19.7510	19.9303	20.1689	20.3280	20.3531	20.3642	20.3689	20.3688	20.3565	20.2729	20.0092	19.7217	(90)
Living area fraction									fLA = Living area / (4) =			0.4663	(91)
MIT	20.0946	20.2593	20.4807	20.6290	20.6534	20.6605	20.6631	20.6630	20.6545	20.5748	20.3275	20.0642	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0946	20.2593	20.4807	20.6290	20.6534	20.6605	20.6631	20.6630	20.6545	20.5748	20.3275	20.0642	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9404	0.9002	0.7998	0.5942	0.4127	0.3059	0.2465	0.2906	0.4648	0.7445	0.9007	0.9498	(94)
Useful gains	552.5820	598.3955	621.2894	562.6696	445.1856	329.4043	252.6245	256.9595	347.9863	463.1695	509.0750	534.9752	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	750.1804	739.2834	684.3902	572.7824	446.2351	329.5308	252.6499	257.0288	349.5347	492.9470	626.8071	744.4884	(97)
Space heating kWh	147.0132	94.6766	46.9470	7.2812	0.7808	0.0000	0.0000	0.0000	0.0000	22.1544	84.7671	155.8778	(98a)
Space heating requirement - total per year (kWh/year)												559.4982	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	147.0132	94.6766	46.9470	7.2812	0.7808	0.0000	0.0000	0.0000	0.0000	22.1544	84.7671	155.8778	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												559.4982	
Space heating per m2											(98c) / (4) =	8.5289	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	147.0132	94.6766	46.9470	7.2812	0.7808	0.0000	0.0000	0.0000	0.0000	22.1544	84.7671	155.8778	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	147.0132	94.6766	46.9470	7.2812	0.7808	0.0000	0.0000	0.0000	0.0000	22.1544	84.7671	155.8778	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
Efficiency of water heater												100.0000	(216)

(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	12.1045	10.9331	12.1045	11.7141	12.1045	11.7141	12.1045	12.1045	11.7141	12.1045	11.7141	12.1045	(231)
Lighting	18.8229	15.1004	13.5963	9.9612	7.6943	6.2863	7.0190	9.1236	11.8506	15.5487	17.5622	19.3460	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.3335	-24.2496	-40.7429	-53.0154	-61.7317	-58.2186	-57.7804	-50.9772	-41.3377	-29.2830	-16.9564	-12.3241	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4576	-6.4518	-15.8354	-29.2573	-40.7194	-40.3248	-40.3981	-31.3264	-21.1298	-10.2536	-3.6695	-1.9361	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	559.4982	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2461.0688	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	142.5210	(230a)
Total electricity for the above, kWh/year	142.5210	(231)
Electricity for lighting (calculated in Appendix L)	151.9116	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-704.7104	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2610.2892	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	559.4982	25.1600	140.7697	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	25.1600	619.2049	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	142.5210	25.1600	35.8583	(249)
Energy for lighting	151.9116	25.1600	38.2210	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.9505	25.1600	-115.9752	
PV Unit electricity exported	-243.7598	5.8100	-14.1624	
Total			-130.1376	(252)
Total energy cost			703.9163	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	559.4982	0.1585	88.6595	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2461.0688	0.1413	347.7259	(264)
Space and water heating			436.3854	(265)
Pumps, fans and electric keep-hot	142.5210	0.1387	19.7694	(267)
Energy for lighting	151.9116	0.1443	21.9255	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.9505	0.1321	-60.8840	
PV Unit electricity exported	-243.7598	0.1225	-29.8531	
Total			-90.7371	(269)
Total CO2, kg/year			387.3433	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	559.4982	1.5865	887.6647	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	1.5225	3746.8812	(278)
Space and water heating			4634.5458	(279)
Pumps, fans and electric keep-hot	142.5210	1.5128	215.6057	(281)
Energy for lighting	151.9116	1.5338	233.0071	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.9505	1.4880	-685.9054	
PV Unit electricity exported	-243.7598	0.4495	-109.5580	
Total			-795.4634	(283)
Total Primary energy kWh/year			4287.6952	(286)

SAP 10 EPC IMPROVEMENTS

Unit 369 L07_Copy

Current energy efficiency rating: C 77
Current environmental impact rating: A 95

N Solar water heating	Not applicable
U Solar photovoltaic panels	Not applicable
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 77
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£834	£834	£0
Space heating	£177	£177	£0
Water heating	£619	£619	£0
Lighting	£38	£38	£0
Generated (PV)	-£130	-£130	£0
Total cost of fuels	£704	£704	£0
Total cost of uses	£704	£704	£0
Delivered energy	40 kWh/m²	40 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	65 kWh/m²	65 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.6000 (1b)	x	2.4000 (2b)	=	157.4400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	157.4400	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.3500	1.2357	23.9116			(27)
External Wall 1	41.2300	19.3500	21.8800	0.1400	3.0632	14.0000	306.3200	(29a)
Total net area of external elements Aum(A, m2)			41.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.9748			(33)
Party Wall 1			30.2400	0.0000	0.0000	20.0000	604.8000	(32)
Wall to corridor			14.1800	0.0000	0.0000	20.0000	283.6000	(32)
Party Floor 1			65.6000			80.0000	5248.0000	(32d)
Party Ceiling 1			65.6000			80.0000	5248.0000	(32b)
Internal Wall 1			114.4800			9.0000	1030.3200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12721.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		193.9183 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	15.2700	0.0700	1.0689
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.4500	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.4629 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	30.4377 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.7197	15.5541	15.3885	14.5604	14.3948	13.5668	13.5668	13.4012	13.8980	14.3948	14.7261	15.0573	(38)
Heat transfer coeff	46.1574	45.9918	45.8262	44.9981	44.8325	44.0045	44.0045	43.8389	44.3357	44.8325	45.1637	45.4950	(39)
Average = Sum(39)m / 12 =												44.9567	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7036	0.7011	0.6986	0.6859	0.6834	0.6708	0.6708	0.6683	0.6758	0.6834	0.6885	0.6935	(40)
HLP (average)												0.6853	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.1348 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
82.5173	81.2772	79.4702	76.0128	73.4613	70.6159	68.9985	70.7919	72.7577	75.8128	79.3445	82.2011	(42a)

Hot water usage for baths

25.9306	25.5455	25.0032	24.0033	23.2545	22.4243	21.9759	22.5144	23.1007	23.9891	25.0096	25.8429	(42b)

Hot water usage for other uses

36.4921	35.1651	33.8381	32.5112	31.1842	29.8572	29.8572	31.1842	32.5112	33.8381	35.1651	36.4921	(42c)

Average daily hot water use (litres/day)		133.2946 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.9400	141.9879	138.3115	132.5272	127.9000	122.8974	120.8316	124.4905	128.3696	133.6401	139.5193	144.5362	(44)
Energy conte	229.5496	202.1888	212.5797	181.4231	172.1780	151.1167	146.1353	154.1452	158.2926	181.3483	198.7708	226.3088	(45)
Energy content (annual)										Total = Sum(45)m =		2214.0368	
Distribution loss (46)m = 0.15 x (45)m	34.4324	30.3283	31.8870	27.2135	25.8267	22.6675	21.9203	23.1218	23.7439	27.2023	29.8156	33.9463	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
									Total per year (kWh/year) = Sum(64)m =		2461.0688	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000 (64a)

Heat gains from water heating, kWh/month

93.1099	82.3881	87.4674	76.5664	74.0338	66.4895	65.3746	68.0379	68.8755	77.0830	82.3345	92.0323	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.5047	19.1002	15.5334	11.7598	8.7906	7.4214	8.0190	10.4234	13.9903	17.7639	20.7331	22.1023	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	278.8333	281.7267	274.4354	258.9131	239.3189	220.9031	208.6002	205.7068	212.9981	228.5205	248.1147	266.5304	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(70)
Losses e.g. evaporation (negative values) (Table 5)	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	(71)
Water heating gains (Table 5)	125.1477	122.6013	117.5637	106.3422	99.5078	92.3465	87.8691	91.4488	95.6604	103.6061	114.3535	123.6993	(72)

Total internal gains

	518.1243	516.0669	500.1711	469.6536	440.2559	413.3096	397.1270	400.2177	415.2875	442.5292	475.8399	504.9707 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5900	10.6334	0.6300	0.8270	0.7700	13.7831	(74)
Northeast	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(75)
Northwest	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(81)

Solar gains	77.9864	157.0279	280.2162	458.5828	616.6334	657.8250	615.1898	490.0648	340.7231	191.0654	97.7876	63.9219	(83)
Total gains	596.1107	673.0949	780.3873	928.2365	1056.8893	1071.1345	1012.3168	890.2825	756.0106	633.5945	573.6275	568.8927	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.5559	76.8316	77.1093	78.5282	78.8183	80.3014	80.3014	80.6047	79.7015	78.8183	78.2402	77.6706	
alpha	6.1037	6.1221	6.1406	6.2352	6.2546	6.3534	6.3534	6.3736	6.3134	6.2546	6.2160	6.1780	
util living area	0.9437	0.8971	0.7825	0.5777	0.3938	0.2629	0.1913	0.2265	0.4038	0.7039	0.8971	0.9531	(86)
MIT	20.5409	20.6986	20.8811	20.9817	20.9983	20.9999	21.0000	21.0000	20.9987	20.9551	20.7496	20.5092	(87)
Th 2	20.3376	20.3399	20.3421	20.3533	20.3555	20.3667	20.3667	20.3689	20.3622	20.3555	20.3510	20.3466	(88)
util rest of house	0.9339	0.8815	0.7577	0.5488	0.3667	0.2369	0.1637	0.1954	0.3668	0.6677	0.8790	0.9447	(89)
MIT 2	19.8185	20.0094	20.2201	20.3364	20.3542	20.3666	20.3667	20.3689	20.3613	20.3148	20.0834	19.7875	(90)
Living area fraction									fLA = Living area / (4) =			0.4663	(91)
MIT	20.1554	20.3308	20.5284	20.6373	20.6546	20.6619	20.6620	20.6632	20.6585	20.6134	20.3941	20.1241	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1554	20.3308	20.5284	20.6373	20.6546	20.6619	20.6620	20.6632	20.6585	20.6134	20.3941	20.1241	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9309	0.8813	0.7649	0.5616	0.3793	0.2490	0.1766	0.2099	0.3841	0.6825	0.8803	0.9414	(94)
Useful gains	554.9067	593.1911	596.9001	521.2762	400.8703	266.7233	178.7442	186.8865	290.3468	432.4035	504.9500	535.5811	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	731.8424	709.6904	642.8668	528.1577	401.4553	266.7525	178.7466	186.8936	290.7766	448.9253	600.4104	724.4643	(97)
Space heating kWh	131.6402	78.2875	34.1992	4.9547	0.4352	0.0000	0.0000	0.0000	0.0000	12.2922	68.7315	140.5291	(98a)
Space heating requirement - total per year (kWh/year)												471.0696	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	131.6402	78.2875	34.1992	4.9547	0.4352	0.0000	0.0000	0.0000	0.0000	12.2922	68.7315	140.5291	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												471.0696	
Space heating per m2											(98c) / (4) =	7.1809	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	131.6402	78.2875	34.1992	4.9547	0.4352	0.0000	0.0000	0.0000	0.0000	12.2922	68.7315	140.5291	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	131.6402	78.2875	34.1992	4.9547	0.4352	0.0000	0.0000	0.0000	0.0000	12.2922	68.7315	140.5291	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	12.1045	10.9331	12.1045	11.7141	12.1045	11.7141	12.1045	12.1045	11.7141	12.1045	11.7141	12.1045	(231)
Lighting	18.8229	15.1004	13.5963	9.9612	7.6943	6.2863	7.0190	9.1236	11.8506	15.5487	17.5622	19.3460	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.8151	-25.1332	-40.5864	-50.8024	-59.6183	-57.3843	-56.4723	-50.9617	-41.6122	-30.4646	-18.2004	-13.3279	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													

(233b)m	-2.9195	-6.9836	-16.0113	-27.2032	-38.1758	-39.2360	-38.6794	-31.3088	-21.3818	-11.1448	-4.1988	-2.2253	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	471.0696	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2461.0688	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	142.5210	(230a)
Total electricity for the above, kWh/year	142.5210	(231)
Electricity for lighting (calculated in Appendix L)	151.9116	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-699.8470	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2526.7240	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	471.0696	16.4900	77.6794	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	16.4900	405.8302	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	142.5210	16.4900	23.5017	(249)
Energy for lighting	151.9116	16.4900	25.0502	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.3787	16.4900	-75.9165	
PV Unit electricity exported	-239.4682	5.5900	-13.3863	
Total			-89.3027	(252)
Total energy cost			442.7588	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.4412	(257)
SAP value		76.6387	
SAP rating (Section 12)		77	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	471.0696	0.1591	74.9382	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2461.0688	0.1413	347.7259	(264)
Space and water heating			422.6642	(265)
Pumps, fans and electric keep-hot	142.5210	0.1387	19.7694	(267)
Energy for lighting	151.9116	0.1443	21.9255	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.3787	0.1324	-60.9461	
PV Unit electricity exported	-239.4682	0.1230	-29.4551	
Total			-90.4011	(269)
Total CO2, kg/year			373.9580	(272)
CO2 emissions per m2			5.7000	(273)
EI value			95.4692	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		65.6000 (1b)	x	2.4000 (2b)	=	157.4400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.6000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	157.4400	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.3500	1.2357	23.9116			(27)
External Wall 1	41.2300	19.3500	21.8800	0.1400	3.0632	14.0000	306.3200	(29a)
Total net area of external elements Aum(A, m2)			41.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.9748			(33)
Party Wall 1			30.2400	0.0000	0.0000	20.0000	604.8000	(32)
Wall to corridor			14.1800	0.0000	0.0000	20.0000	283.6000	(32)
Party Floor 1			65.6000			80.0000	5248.0000	(32d)
Party Ceiling 1			65.6000			80.0000	5248.0000	(32b)
Internal Wall 1			114.4800			9.0000	1030.3200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12721.0400	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	193.9183	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	15.2700	0.0700	1.0689
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.4500	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	3.4629	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	30.4377	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.8853	15.8853	15.5541	14.5604	14.3948	13.7324	13.4012	13.4012	14.0636	14.8917	15.2229	15.0573	(38)
Heat transfer coeff	46.3230	46.3230	45.9918	44.9981	44.8325	44.1701	43.8389	43.8389	44.5013	45.3294	45.6606	45.4950	(39)
Average = Sum(39)m / 12 =												45.1085	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7061	0.7061	0.7011	0.6859	0.6834	0.6733	0.6683	0.6683	0.6784	0.6910	0.6960	0.6935	(40)
HLP (average)												0.6876	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1348	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
82.5173	81.2772	79.4702	76.0128	73.4613	70.6159	68.9985	70.7919	72.7577	75.8128	79.3445	82.2011	(42a)

Hot water usage for baths

25.9306	25.5455	25.0032	24.0033	23.2545	22.4243	21.9759	22.5144	23.1007	23.9891	25.0096	25.8429	(42b)

Hot water usage for other uses

36.4921	35.1651	33.8381	32.5112	31.1842	29.8572	29.8572	31.1842	32.5112	33.8381	35.1651	36.4921	(42c)

Average daily hot water use (litres/day)	133.2946 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.9400	141.9879	138.3115	132.5272	127.9000	122.8974	120.8316	124.4905	128.3696	133.6401	139.5193	144.5362	(44)
Energy conte	229.5496	202.1888	212.5797	181.4231	172.1780	151.1167	146.1353	154.1452	158.2926	181.3483	198.7708	226.3088	(45)
Energy content (annual)										Total = Sum(45)m =		2214.0368	

Distribution loss (46)m = 0.15 x (45)m

34.4324	30.3283	31.8870	27.2135	25.8267	22.6675	21.9203	23.1218	23.7439	27.2023	29.8156	33.9463	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)

Total per year (kWh/year) = Sum(64)m = 2461.0688 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

93.1099	82.3881	87.4674	76.5664	74.0338	66.4895	65.3746	68.0379	68.8755	77.0830	82.3345	92.0323	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

21.5047	19.1002	15.5334	11.7598	8.7906	7.4214	8.0190	10.4234	13.9903	17.7639	20.7331	22.1023	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

278.8333	281.7267	274.4354	258.9131	239.3189	220.9031	208.6002	205.7068	212.9981	228.5205	248.1147	266.5304	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	(71)

Water heating gains (Table 5)

125.1477	122.6013	117.5637	106.3422	99.5078	92.3465	87.8691	91.4488	95.6604	103.6061	114.3535	123.6993	(72)

Total internal gains

518.1243	516.0669	500.1711	469.6536	440.2559	413.3096	397.1270	400.2177	415.2875	442.5292	475.8399	504.9707	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5900	9.5462	0.6300	0.8270	0.7700	12.3738	(74)
Northeast	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(75)
Northwest	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(81)

Solar gains 69.4528	148.6778	276.6041	477.3240	638.3689	663.6861	627.6104	484.0300	333.4428	179.5688	89.3871	58.2939	(83)
Total gains 587.5771	664.7447	776.7752	946.9776	1078.6248	1076.9957	1024.7374	884.2477	748.7303	622.0980	565.2270	563.2647	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.2822	76.2822	76.8316	78.5282	78.8183	80.0003	80.6047	80.6047	79.4049	77.9544	77.3889	77.6706	
alpha	6.0855	6.0855	6.1221	6.2352	6.2546	6.3334	6.3736	6.3736	6.2937	6.1970	6.1593	6.1780	
util living area	0.9523	0.9151	0.8170	0.6098	0.4269	0.3197	0.2609	0.3073	0.4846	0.7655	0.9164	0.9604	(86)
MIT	20.4877	20.6359	20.8375	20.9735	20.9971	20.9996	20.9999	20.9998	20.9955	20.9203	20.6918	20.4562	(87)
Th 2	20.3354	20.3354	20.3399	20.3533	20.3555	20.3645	20.3689	20.3689	20.3600	20.3488	20.3443	20.3466	(88)
util rest of house	0.9439	0.9018	0.7950	0.5824	0.4005	0.2937	0.2339	0.2760	0.4477	0.7329	0.9011	0.9533	(89)
MIT 2	19.7510	19.9303	20.1689	20.3280	20.3531	20.3642	20.3689	20.3688	20.3565	20.2729	20.0092	19.7217	(90)
Living area fraction									fLA = Living area / (4) =			0.4663	(91)
MIT	20.0946	20.2593	20.4807	20.6290	20.6534	20.6605	20.6631	20.6630	20.6545	20.5748	20.3275	20.0642	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0946	20.2593	20.4807	20.6290	20.6534	20.6605	20.6631	20.6630	20.6545	20.5748	20.3275	20.0642	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9404	0.9002	0.7998	0.5942	0.4127	0.3059	0.2465	0.2906	0.4648	0.7445	0.9007	0.9498	(94)
Useful gains	552.5820	598.3955	621.2894	562.6696	445.1856	329.4043	252.6245	256.9595	347.9863	463.1695	509.0750	534.9752	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	750.1804	739.2834	684.3902	572.7824	446.2351	329.5308	252.6499	257.0288	349.5347	492.9470	626.8071	744.4884	(97)
Space heating kWh	147.0132	94.6766	46.9470	7.2812	0.7808	0.0000	0.0000	0.0000	0.0000	22.1544	84.7671	155.8778	(98a)

Space heating requirement - total per year (kWh/year) 559.4982

Solar heating kWh

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)

Solar heating contribution - total per year (kWh/year) 0.0000

Space heating kWh

147.0132	94.6766	46.9470	7.2812	0.7808	0.0000	0.0000	0.0000	0.0000	22.1544	84.7671	155.8778	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 559.4982

Space heating per m2 (98c) / (4) = 8.5289 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	147.0132	94.6766	46.9470	7.2812	0.7808	0.0000	0.0000	0.0000	0.0000	22.1544	84.7671	155.8778	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	147.0132	94.6766	46.9470	7.2812	0.7808	0.0000	0.0000	0.0000	0.0000	22.1544	84.7671	155.8778	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	12.1045	10.9331	12.1045	11.7141	12.1045	11.7141	12.1045	12.1045	11.7141	12.1045	11.7141	12.1045	(231)
Lighting	18.8229	15.1004	13.5963	9.9612	7.6943	6.2863	7.0190	9.1236	11.8506	15.5487	17.5622	19.3460	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.3335	-24.2496	-40.7429	-53.0154	-61.7317	-58.2186	-57.7804	-50.9772	-41.3377	-29.2830	-16.9564	-12.3241	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4576	-6.4518	-15.8354	-29.2573	-40.7194	-40.3248	-40.3981	-31.3264	-21.1298	-10.2536	-3.6695	-1.9361	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												559.4982	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2461.0688	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)													
mechanical ventilation fans (SFP = 0.7420)												142.5210	(230a)
Total electricity for the above, kWh/year												142.5210	(231)
Electricity for lighting (calculated in Appendix L)												151.9116	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-704.7104	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2610.2892	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	559.4982	25.1600	140.7697	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	25.1600	619.2049	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	142.5210	25.1600	35.8583	(249)
Energy for lighting	151.9116	25.1600	38.2210	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.9505	25.1600	-115.9752	
PV Unit electricity exported	-243.7598	5.8100	-14.1624	
Total			-130.1376	(252)
Total energy cost			703.9163	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	559.4982	0.1585	88.6595	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2461.0688	0.1413	347.7259	(264)
Space and water heating			436.3854	(265)
Pumps, fans and electric keep-hot	142.5210	0.1387	19.7694	(267)
Energy for lighting	151.9116	0.1443	21.9255	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.9505	0.1321	-60.8840	
PV Unit electricity exported	-243.7598	0.1225	-29.8531	
Total			-90.7371	(269)
Total CO2, kg/year			387.3433	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	559.4982	1.5865	887.6647	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	1.5225	3746.8812	(278)
Space and water heating			4634.5458	(279)
Pumps, fans and electric keep-hot	142.5210	1.5128	215.6057	(281)
Energy for lighting	151.9116	1.5338	233.0071	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.9505	1.4880	-685.9054	
PV Unit electricity exported	-243.7598	0.4495	-109.5580	
Total			-795.4634	(283)
Total Primary energy kWh/year			4287.6952	(286)

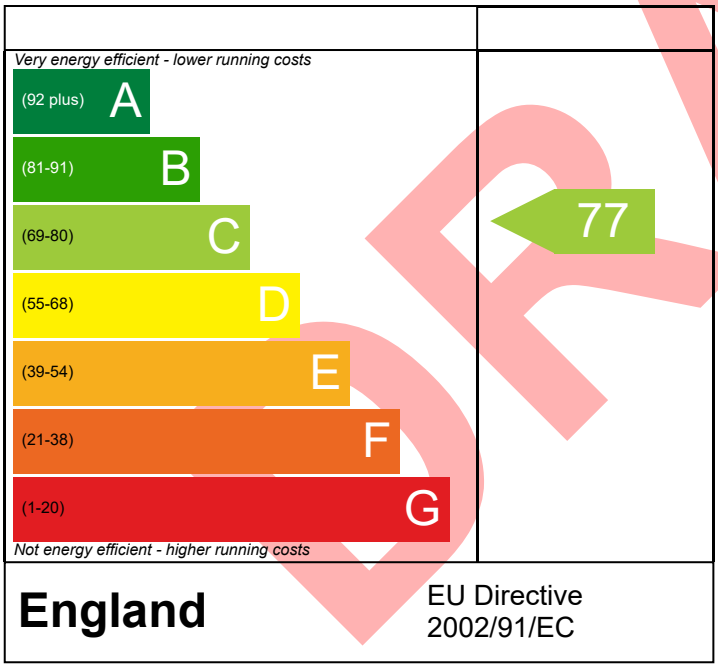
Predicted Energy Assessment

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	65.6 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

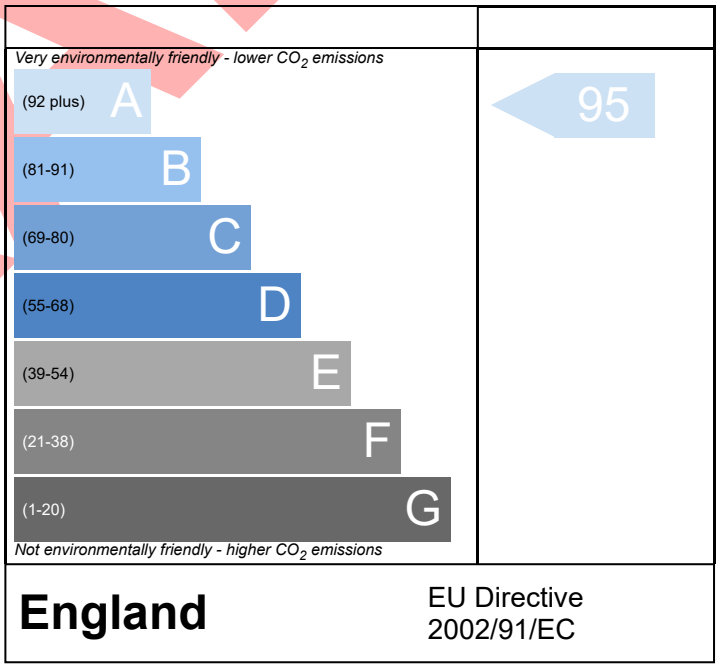
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:02

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	71 m^2
Site Reference	Unit 370 L07_Copy	Plot Reference	Unit 370 L07_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*10.3 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	4.64 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*55.61 kWh_{PE}/m^2*	
Dwelling primary energy	52.51 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*18.0 kWh/m^2*	
Dwelling fabric energy efficiency	17.1 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	11	0.14 **(!)**
Party wall: Party Wall (1)	52.62	0 **(!)**
Party wall: Party Wall (2)	15.55	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	11.81	North East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.92 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 370 L07_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 370 L07_Copy	**Prop Type Ref**	Unit 126 L06
Property			

SAP Rating	80 C	**DER**	4.64	**TER**	10.30
Environmental	96 A	**% DER < TER**			54.95
CO_2 Emissions (t/year)	0.33	**DFEE**	17.06	**TFEE**	17.98
Compliance Check	See BREL	**% DFEE < TFEE**			5.14
% DPER < TPER	5.58	**DPER**	52.51	**TPER**	55.61

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 14111.0700	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.8035	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545

E4 Jamb	13.9200	0.0500	0.6960	
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.8660 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.2026	16.0392	15.8758	15.0589	14.8955	14.0786	14.0786	13.9153	14.4054	14.8955	15.2223	15.5490	(38)
Heat transfer coeff	34.2027	34.0393	33.8759	33.0590	32.8956	32.0787	32.0787	31.9154	32.4055	32.8956	33.2224	33.5491	(39)

Average = Sum(39)m / 12 = 33.0182

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4819	0.4796	0.4773	0.4658	0.4634	0.4519	0.4519	0.4496	0.4565	0.4634	0.4681	0.4727	(40)
HLP (average)												0.4652	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2697 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day) 138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)

Energy content (annual) Total = Sum(45)m = 2297.5146

Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)

Total per year (kWh/year) = Sum(64)m = 2544.5466 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(75)

Solar gains	48.1118	97.9329	176.4440	289.7718	389.5101	415.2590	388.4663	309.6898	214.9998	119.6818	60.5371	39.2905	(83)
Total gains	594.4583	642.1364	703.7861	784.8198	853.3337	850.5024	806.5649	731.0038	652.3178	585.8947	562.0348	571.6354	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.6034	115.1535	115.7089	118.5680	119.1569	122.1913	122.1913	122.8168	120.9592	119.1569	117.9849	116.8358	
alpha	8.6402	8.6769	8.7139	8.9045	8.9438	9.1461	9.1461	9.1878	9.0639	8.9438	8.8657	8.7891	
util living area													
	0.8775	0.8131	0.6885	0.5091	0.3585	0.2414	0.1750	0.2008	0.3428	0.5819	0.7916	0.8914	(86)
MIT	20.8955	20.9454	20.9859	20.9990	21.0000	21.0000	21.0000	21.0000	21.0000	20.9975	20.9643	20.8857	(87)
Th 2	20.5375	20.5396	20.5417	20.5523	20.5544	20.5651	20.5651	20.5672	20.5608	20.5544	20.5502	20.5460	(88)
util rest of house													
	0.8633	0.7958	0.6685	0.4904	0.3413	0.2250	0.1577	0.1819	0.3210	0.5575	0.7712	0.8782	(89)
MIT 2	20.4234	20.4818	20.5277	20.5514	20.5544	20.5651	20.5651	20.5672	20.5608	20.5523	20.5139	20.4203	(90)
Living area fraction										fLA = Living area / (4) =		0.4060	(91)
MIT	20.6151	20.6700	20.7137	20.7331	20.7353	20.7417	20.7417	20.7429	20.7391	20.7331	20.6968	20.6093	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6151	20.6700	20.7137	20.7331	20.7353	20.7417	20.7417	20.7429	20.7391	20.7331	20.6968	20.6093	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8657	0.8008	0.6760	0.4979	0.3483	0.2316	0.1647	0.1896	0.3298	0.5673	0.7780	0.8801	(94)
Useful gains	514.6438	514.2072	475.7927	390.7925	297.2070	197.0168	132.8596	138.6063	215.1380	332.4041	437.2668	503.1190	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	558.0190	536.7995	481.5030	391.1911	297.2225	197.0170	132.8596	138.6063	215.1442	333.3337	451.7174	550.5165	(97)
Space heating kWh													
	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(98a)
Space heating requirement - total per year (kWh/year)												98.3601	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												98.3601	
Space heating per m2											(98c) / (4) =	1.3857	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)
Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.8048	-26.6478	-43.2456	-54.4944	-64.0203	-61.6099	-60.6290	-54.7463	-44.7493	-32.6681	-19.3717	-14.1696	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.4726	-8.1139	-18.0130	-29.9352	-41.8274	-42.9674	-42.3587	-34.2994	-23.4325	-12.3679	-4.8722	-2.6645	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	98.3601	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2544.5466	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	154.2094	(230a)
Total electricity for the above, kWh/year	154.2094	(231)
Electricity for lighting (calculated in Appendix L)	163.7369	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-757.4814	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2203.3717	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	98.3601	16.4900	16.2196	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	16.4900	419.5957	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	16.4900	25.4291	(249)
Energy for lighting	163.7369	16.4900	27.0002	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.1568	16.4900	-81.3216	
PV Unit electricity exported	-264.3246	5.5900	-14.7757	
Total			-96.0973	(252)
Total energy cost			392.1474	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2172	(257)
SAP value		80.2689	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	98.3601	0.1606	15.7950	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			375.3396	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.1568	0.1323	-65.2544	
PV Unit electricity exported	-264.3246	0.1234	-32.6244	
Total			-97.8788	(269)
Total CO2, kg/year			322.4838	(272)
CO2 emissions per m2			4.5400	(273)
EI value			96.2741	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14111.0700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 198.8035 (35)
List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4	Jamb	13.9200	0.0500	0.6960
E7	Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18	Party wall between dwellings	5.4000	0.0600	0.3240
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.8660 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3659	16.3659	16.0392	15.0589	14.8955	14.2420	13.9153	13.9153	14.5688	15.3857	15.7124	15.5490	(38)
Heat transfer coeff	34.3660	34.3660	34.0393	33.0590	32.8956	32.2421	31.9154	31.9154	32.5689	33.3858	33.7125	33.5491	(39)

Average = Sum(39)m / 12 = 33.1679

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4842	0.4842	0.4796	0.4658	0.4634	0.4542	0.4496	0.4496	0.4588	0.4704	0.4750	0.4727	(40)
HLP (average)												0.4673	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2697 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day) 138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
										Total per year (kWh/year) = Sum(64)m =		2544.5466	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)													
	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains													
	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(75)

Solar gains	42.7730	92.6022	174.0550	301.5827	403.2921	419.0362	396.3745	305.8819	210.3213	112.3593	55.2465	35.7661	(83)
Total gains	589.1195	636.8057	701.3971	796.6307	867.1157	854.2796	814.4731	727.1958	647.6393	578.5722	556.7443	568.1110	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.0586	114.0586	115.1535	118.5680	119.1569	121.5721	122.8168	122.8168	120.3524	117.4076	116.2696	116.8358	
alpha	8.6039	8.6039	8.6769	8.9045	8.9438	9.1048	9.1878	9.1878	9.0235	8.8272	8.7513	8.7891	
util living area													
	0.8948	0.8436	0.7313	0.5425	0.3907	0.2944	0.2390	0.2721	0.4123	0.6468	0.8263	0.9072	(86)
MIT	20.8725	20.9227	20.9763	20.9982	20.9999	21.0000	21.0000	21.0000	20.9999	20.9935	20.9463	20.8626	(87)
Th 2	20.5354	20.5354	20.5396	20.5523	20.5544	20.5630	20.5672	20.5672	20.5587	20.5481	20.5438	20.5460	(88)
util rest of house													
	0.8819	0.8278	0.7122	0.5242	0.3738	0.2779	0.2221	0.2531	0.3901	0.6222	0.8073	0.8955	(89)
MIT 2	20.3944	20.4521	20.5153	20.5506	20.5544	20.5629	20.5672	20.5672	20.5586	20.5421	20.4880	20.3930	(90)
Living area fraction										fLA = Living area / (4) =		0.4060	(91)
MIT	20.5885	20.6432	20.7024	20.7323	20.7353	20.7404	20.7429	20.7429	20.7378	20.7254	20.6741	20.5837	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5885	20.6432	20.7024	20.7323	20.7353	20.7404	20.7429	20.7429	20.7378	20.7254	20.6741	20.5837	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8835	0.8316	0.7190	0.5316	0.3807	0.2846	0.2290	0.2608	0.3991	0.6319	0.8129	0.8965	(94)
Useful gains	520.4584	529.5388	504.3299	423.4968	330.0802	243.1167	186.4792	189.6703	258.4856	365.5902	452.5648	509.3180	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	573.5183	561.6502	514.0764	424.2235	330.1165	243.1185	186.4794	189.6709	258.5247	368.0921	474.4733	566.4323	(97)
Space heating kWh													
	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930	(98a)
Space heating requirement - total per year (kWh/year)												128.9856	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												128.9856	
Space heating per m2										(98c) / (4) =		1.8172	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)

Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-15.2338	-25.6721	-43.2787	-56.7922	-66.2633	-62.5005	-62.0252	-54.7629	-44.4553	-31.3120	-18.0261	-13.1034 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.9401	-7.5576	-17.9590	-32.2559	-44.6250	-44.1582	-44.2385	-34.3187	-23.1566	-11.4806	-4.2984	-2.3312 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	128.9856 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2544.5466 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	154.2094 (230a)
Total electricity for the above, kWh/year	154.2094 (231)
Electricity for lighting (calculated in Appendix L)	163.7369 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-762.7453 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2228.7332 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	128.9856	25.1600	32.4528	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	25.1600	640.2079	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	25.1600	38.7991	(249)
Energy for lighting	163.7369	25.1600	41.1962	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.4255	25.1600	-124.1459	
PV Unit electricity exported	-269.3198	5.8100	-15.6475	
Total			-139.7933	(252)
Total energy cost			612.8627	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	128.9856	0.1600	20.6366	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			380.1811	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.4255	0.1320	-65.1384	
PV Unit electricity exported	-269.3198	0.1229	-33.1064	
Total			-98.2448	(269)
Total CO2, kg/year			326.9594	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	128.9856	1.5921	205.3619	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	1.5225	3874.0629	(278)
Space and water heating			4079.4248	(279)
Pumps, fans and electric keep-hot	154.2094	1.5128	233.2880	(281)
Energy for lighting	163.7369	1.5338	251.1452	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.4255	1.4878	-734.0970	
PV Unit electricity exported	-269.3198	0.4511	-121.5003	
Total			-855.5973	(283)
Total Primary energy kWh/year			3708.2608	(286)

SAP 10 EPC IMPROVEMENTS

Unit 370 L07_Copy

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 80
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£753	£753	£0
Space heating	£71	£71	£0
Water heating	£640	£640	£0
Lighting	£41	£41	£0
Generated (PV)	-£140	-£140	£0
Total cost of fuels	£613	£613	£0
Total cost of uses	£612	£612	£0
Delivered energy	31 kWh/m²	31 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	52 kWh/m²	52 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14111.0700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		198.8035 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.8660 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.2026	16.0392	15.8758	15.0589	14.8955	14.0786	14.0786	13.9153	14.4054	14.8955	15.2223	15.5490	(38)
Heat transfer coeff	34.2027	34.0393	33.8759	33.0590	32.8956	32.0787	32.0787	31.9154	32.4055	32.8956	33.2224	33.5491	(39)
Average = Sum(39)m / 12 =												33.0182	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4819	0.4796	0.4773	0.4658	0.4634	0.4519	0.4519	0.4496	0.4565	0.4634	0.4681	0.4727	(40)
HLP (average)												0.4652	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.2697 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)

Hot water usage for baths

26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)

Hot water usage for other uses

37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day)		138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
									Total per year (kWh/year) = Sum(64)m =		2544.5466	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast				11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(75)
Solar gains	48.1118	97.9329	176.4440	289.7718	389.5101	415.2590	388.4663	309.6898	214.9998	119.6818	60.5371	39.2905	(83)
Total gains	594.4583	642.1364	703.7861	784.8198	853.3337	850.5024	806.5649	731.0038	652.3178	585.8947	562.0348	571.6354	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.6034	115.1535	115.7089	118.5680	119.1569	122.1913	122.1913	122.8168	120.9592	119.1569	117.9849	116.8358	
alpha	8.6402	8.6769	8.7139	8.9045	8.9438	9.1461	9.1461	9.1878	9.0639	8.9438	8.8657	8.7891	
util living area	0.8775	0.8131	0.6885	0.5091	0.3585	0.2414	0.1750	0.2008	0.3428	0.5819	0.7916	0.8914	(86)
MIT	20.8955	20.9454	20.9859	20.9990	21.0000	21.0000	21.0000	21.0000	21.0000	20.9975	20.9643	20.8857	(87)
Th 2	20.5375	20.5396	20.5417	20.5523	20.5544	20.5651	20.5651	20.5672	20.5608	20.5544	20.5502	20.5460	(88)
util rest of house	0.8633	0.7958	0.6685	0.4904	0.3413	0.2250	0.1577	0.1819	0.3210	0.5575	0.7712	0.8782	(89)
MIT 2	20.4234	20.4818	20.5277	20.5514	20.5544	20.5651	20.5651	20.5672	20.5608	20.5523	20.5139	20.4203	(90)
Living area fraction									fLA = Living area / (4) =			0.4060	(91)
MIT	20.6151	20.6700	20.7137	20.7331	20.7353	20.7417	20.7417	20.7429	20.7391	20.7331	20.6968	20.6093	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6151	20.6700	20.7137	20.7331	20.7353	20.7417	20.7417	20.7429	20.7391	20.7331	20.6968	20.6093	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8657	0.8008	0.6760	0.4979	0.3483	0.2316	0.1647	0.1896	0.3298	0.5673	0.7780	0.8801	(94)
Useful gains	514.6438	514.2072	475.7927	390.7925	297.2070	197.0168	132.8596	138.6063	215.1380	332.4041	437.2668	503.1190	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	558.0190	536.7995	481.5030	391.1911	297.2225	197.0170	132.8596	138.6063	215.1442	333.3337	451.7174	550.5165	(97)
Space heating kWh	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(98a)
Space heating requirement - total per year (kWh/year)												98.3601	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												98.3601	
Space heating per m2										(98c) / (4) =		1.3857	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)
Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.8048	-26.6478	-43.2456	-54.4944	-64.0203	-61.6099	-60.6290	-54.7463	-44.7493	-32.6681	-19.3717	-14.1696	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.4726	-8.1139	-18.0130	-29.9352	-41.8274	-42.9674	-42.3587	-34.2994	-23.4325	-12.3679	-4.8722	-2.6645	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												98.3601	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2544.5466	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	154.2094	(230a)
Total electricity for the above, kWh/year	154.2094	(231)
Electricity for lighting (calculated in Appendix L)	163.7369	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-757.4814	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2203.3717	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	98.3601	16.4900	16.2196	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	16.4900	419.5957	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	16.4900	25.4291	(249)
Energy for lighting	163.7369	16.4900	27.0002	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.1568	16.4900	-81.3216	
PV Unit electricity exported	-264.3246	5.5900	-14.7757	
Total			-96.0973	(252)
Total energy cost			392.1474	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2172	(257)
SAP value		80.2689	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	98.3601	0.1606	15.7950	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			375.3396	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.1568	0.1323	-65.2544	
PV Unit electricity exported	-264.3246	0.1234	-32.6244	
Total			-97.8788	(269)
Total CO2, kg/year			322.4838	(272)
CO2 emissions per m2			4.5400	(273)
EI value			96.2741	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 14111.0700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.8035 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	1.8660 (36)
Point Thermal bridges (36a) =	0.0000
Total fabric heat loss (33) + (36) + (36a) =	18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3659	16.3659	16.0392	15.0589	14.8955	14.2420	13.9153	13.9153	14.5688	15.3857	15.7124	15.5490	(38)
Heat transfer coeff	34.3660	34.3660	34.0393	33.0590	32.8956	32.2421	31.9154	31.9154	32.5689	33.3858	33.7125	33.5491	(39)
Average = Sum(39)m / 12 =												33.1679	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4842	0.4842	0.4796	0.4658	0.4634	0.4542	0.4496	0.4496	0.4588	0.4704	0.4750	0.4727	(40)
HLP (average)												0.4673	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2697 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)
Average daily hot water use (litres/day)												138.3203	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
									Total per year (kWh/year) = Sum(64)m =			2544.5466	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(75)

Solar gains	42.7730	92.6022	174.0550	301.5827	403.2921	419.0362	396.3745	305.8819	210.3213	112.3593	55.2465	35.7661	(83)
Total gains	589.1195	636.8057	701.3971	796.6307	867.1157	854.2796	814.4731	727.1958	647.6393	578.5722	556.7443	568.1110	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.0586	114.0586	115.1535	118.5680	119.1569	121.5721	122.8168	122.8168	120.3524	117.4076	116.2696	116.8358	
alpha	8.6039	8.6039	8.6769	8.9045	8.9438	9.1048	9.1878	9.1878	9.0235	8.8272	8.7513	8.7891	
util living area	0.8948	0.8436	0.7313	0.5425	0.3907	0.2944	0.2390	0.2721	0.4123	0.6468	0.8263	0.9072	(86)
MIT	20.8725	20.9227	20.9763	20.9982	20.9999	21.0000	21.0000	21.0000	20.9999	20.9935	20.9463	20.8626	(87)
Th 2	20.5354	20.5354	20.5396	20.5523	20.5544	20.5630	20.5672	20.5672	20.5587	20.5481	20.5438	20.5460	(88)
util rest of house	0.8819	0.8278	0.7122	0.5242	0.3738	0.2779	0.2221	0.2531	0.3901	0.6222	0.8073	0.8955	(89)
MIT 2	20.3944	20.4521	20.5153	20.5506	20.5544	20.5629	20.5672	20.5672	20.5586	20.5421	20.4880	20.3930	(90)
Living area fraction										fLA = Living area / (4) =		0.4060	(91)
MIT	20.5885	20.6432	20.7024	20.7323	20.7353	20.7404	20.7429	20.7429	20.7378	20.7254	20.6741	20.5837	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5885	20.6432	20.7024	20.7323	20.7353	20.7404	20.7429	20.7429	20.7378	20.7254	20.6741	20.5837	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8835	0.8316	0.7190	0.5316	0.3807	0.2846	0.2290	0.2608	0.3991	0.6319	0.8129	0.8965	(94)
Useful gains	520.4584	529.5388	504.3299	423.4968	330.0802	243.1167	186.4792	189.6703	258.4856	365.5902	452.5648	509.3180	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	573.5183	561.6502	514.0764	424.2235	330.1165	243.1185	186.4794	189.6709	258.5247	368.0921	474.4733	566.4323	(97)
Space heating kWh	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930	(98a)
Space heating requirement - total per year (kWh/year)												128.9856	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												128.9856	
Space heating per m2											(98c) / (4) =	1.8172	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													

	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972 (231)
Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-15.2338	-25.6721	-43.2787	-56.7922	-66.2633	-62.5005	-62.0252	-54.7629	-44.4553	-31.3120	-18.0261	-13.1034 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.9401	-7.5576	-17.9590	-32.2559	-44.6250	-44.1582	-44.2385	-34.3187	-23.1566	-11.4806	-4.2984	-2.3312 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	128.9856 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2544.5466 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	154.2094 (230a)
Total electricity for the above, kWh/year	154.2094 (231)
Electricity for lighting (calculated in Appendix L)	163.7369 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-762.7453 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2228.7332 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	128.9856	25.1600	32.4528	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	25.1600	640.2079	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	25.1600	38.7991	(249)
Energy for lighting	163.7369	25.1600	41.1962	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.4255	25.1600	-124.1459	
PV Unit electricity exported	-269.3198	5.8100	-15.6475	
Total			-139.7933	(252)
Total energy cost			612.8627	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	128.9856	0.1600	20.6366	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			380.1811	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.4255	0.1320	-65.1384	
PV Unit electricity exported	-269.3198	0.1229	-33.1064	
Total			-98.2448	(269)
Total CO2, kg/year			326.9594	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	128.9856	1.5921	205.3619	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	1.5225	3874.0629	(278)
Space and water heating			4079.4248	(279)

Pumps, fans and electric keep-hot	154.2094	1.5128	233.2880	(281)
Energy for lighting	163.7369	1.5338	251.1452	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.4255	1.4878	-734.0970	
PV Unit electricity exported	-269.3198	0.4511	-121.5003	
Total			-855.5973	(283)
Total Primary energy kWh/year			3708.2608	(286)

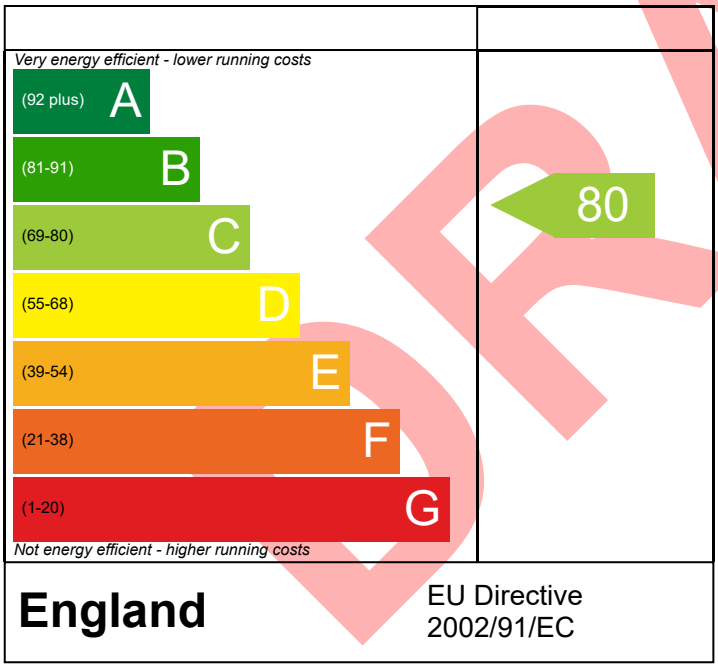
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	70.98 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

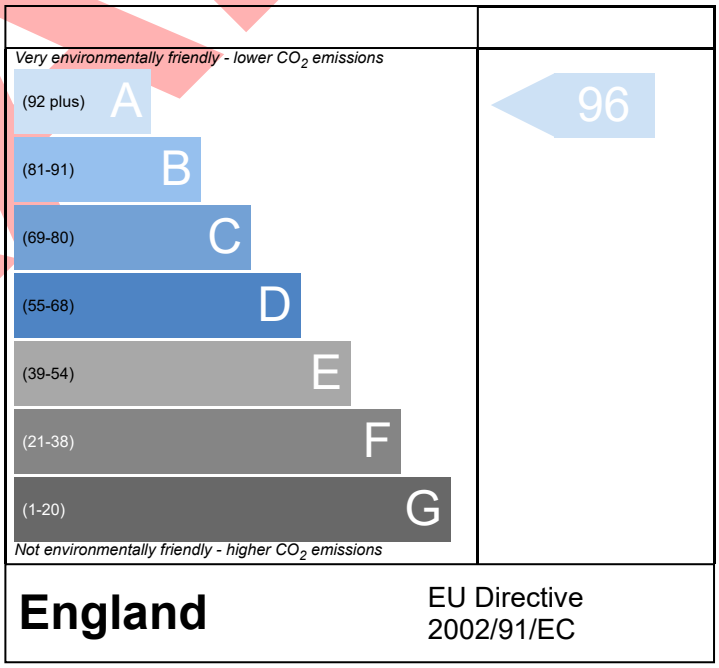
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:02

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	66 m^2
Site Reference	Unit 371 L07_Copy	Plot Reference	Unit 371 L07_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.14 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	5.32 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*60.16 kWh_{PE}/m^2*	
Dwelling primary energy	59.44 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*21.4 kWh/m^2*	
Dwelling fabric energy efficiency	21.6 kWh/m^2	FAIL

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	25.12	0.14 **(!)**
Party wall: Party Wall (1)	55.02	0 **(!)**
Party wall: Party Wall (2)	3.85	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SE, Opening Type 1	11.81	South East	0.83	1.3
NE, Opening Type 1	7.88	North East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.86 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 371 L07_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 371 L07_Copy	**Prop Type Ref**	Unit 371 L07
Property			

SAP Rating	78 C	**DER**	5.32	**TER**	11.14
Environmental	96 A	**% DER < TER**			52.24
CO_2 Emissions (t/year)	0.36	**DFEE**	21.59	**TFEE**	21.38
Compliance Check	See BREL	**% DFEE < TFEE**			-0.98
% DPER < TPER	1.20	**DPER**	59.44	**TPER**	60.16

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.4100	(1b)	x 2.4000	(2b) =	159.3840	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.4100					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		159.3840	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.8100	19.6900	25.1200	0.1400	3.5168	14.0000	351.6800	(29a)
Total net area of external elements Aum(A, m2)			44.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.8485			(33)
Party Wall 1			55.0200	0.0000	0.0000	20.0000	1100.4000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.4100			80.0000	5312.8000	(32d)
Party Ceiling 1			66.4100			80.0000	5312.8000	(32b)
Internal Wall 1			140.4500			9.0000	1264.0500	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13418.7300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.0589 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240

E4 Jamb	23.2000	0.0500	1.1600	
E7 Party floor between dwellings (in blocks of flats)	16.5900	0.0700	1.1613	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	21.8000	0.0000	0.0000	
E16 Corner (normal)	5.4000	0.0900	0.4860	
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				3.5553 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	31.4038 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.9138	15.7461	15.5785	14.7402	14.5726	13.7343	13.7343	13.5667	14.0696	14.5726	14.9079	15.2432	(38)
Heat transfer coeff	47.3176	47.1500	46.9823	46.1441	45.9764	45.1382	45.1382	44.9705	45.4735	45.9764	46.3117	46.6470	(39)
Average = Sum(39)m / 12 =												46.1022	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7125	0.7100	0.7075	0.6948	0.6923	0.6797	0.6797	0.6772	0.6847	0.6923	0.6974	0.7024	(40)
HLP (average)												0.6942	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.1559	(42)
Hot water usage for mixer showers	83.0050	81.7576	79.9399	76.4620	73.8955	71.0332	69.4063	71.2103	73.1878	76.2609	79.8135	82.6870	(42a)
Hot water usage for baths	26.0831	25.6958	25.1503	24.1445	23.3913	22.5562	22.1051	22.6468	23.2366	24.1302	25.1567	25.9950	(42b)
Hot water usage for other uses	36.7088	35.3739	34.0390	32.7042	31.3693	30.0344	30.0344	31.3693	32.7042	34.0390	35.3739	36.7088	(42c)
Average daily hot water use (litres/day)												134.0826	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7969	142.8273	139.1292	133.3107	128.6561	123.6239	121.5459	125.2264	129.1285	134.4302	140.3441	145.3907	(44)
Energy conte	230.9067	203.3841	213.8364	182.4956	173.1958	152.0100	146.9993	155.0565	159.2284	182.4205	199.9459	227.6467	(45)
Energy content (annual)											Total = Sum(45)m =	2227.1258	
Distribution loss (46)m = 0.15 x (45)m	34.6360	30.5076	32.0755	27.3743	25.9794	22.8015	22.0499	23.2585	23.8843	27.3631	29.9919	34.1470	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
										Total per year (kWh/year) = Sum(64)m =		2474.1578	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	93.5611	82.7855	87.8852	76.9230	74.3722	66.7865	65.6619	68.3409	69.1866	77.4394	82.7252	92.4772	(65)

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5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7302	19.3006	15.6963	11.8831	8.8827	7.4992	8.1031	10.5328	14.1371	17.9502	20.9506	22.3341	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.7577	284.6815	277.3137	261.6285	241.8288	223.2199	210.7880	207.8643	215.2321	230.9172	250.7169	269.3258	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	(71)
Water heating gains (Table 5)	125.7542	123.1928	118.1253	106.8375	99.9627	92.7591	88.2552	91.8561	96.0926	104.0853	114.8961	124.2973	(72)
Total internal gains	522.4518	520.3846	504.3451	473.5589	443.8841	416.6880	400.3562	403.4629	418.6715	446.1625	479.7734	509.1670	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(75)
Southeast	11.8100	36.7938	0.6300	0.8270	0.7700	156.8932	(77)

Solar gains	188.9949	332.5911	483.3882	646.4144	767.3690	780.8797	744.9195	651.7680	539.3863	375.2206	228.3142	160.4838	(83)
Total gains	711.4468	852.9757	987.7333	1119.9732	1211.2531	1197.5676	1145.2757	1055.2309	958.0577	821.3831	708.0876	669.6508	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.7745	79.0546	79.3367	80.7780	81.0725	82.5781	82.5781	82.8860	81.9692	81.0725	80.4855	79.9070	
alpha	6.2516	6.2703	6.2891	6.3852	6.4048	6.5052	6.5052	6.5257	6.4646	6.4048	6.3657	6.3271	
util living area	0.9030	0.8075	0.6675	0.4956	0.3527	0.2412	0.1734	0.1960	0.3273	0.5744	0.8198	0.9213	(86)
MIT	20.6897	20.8522	20.9540	20.9930	20.9993	21.0000	21.0000	21.0000	20.9997	20.9866	20.8667	20.6491	(87)
Th 2	20.3298	20.3320	20.3342	20.3454	20.3476	20.3588	20.3588	20.3610	20.3543	20.3476	20.3432	20.3387	(88)
util rest of house	0.8881	0.7855	0.6410	0.4695	0.3281	0.2171	0.1481	0.1688	0.2968	0.5404	0.7950	0.9085	(89)
MIT 2	19.9885	20.1767	20.2890	20.3392	20.3471	20.3588	20.3588	20.3610	20.3541	20.3361	20.2070	19.9486	(90)
Living area fraction										fLA = Living area / (4) =		0.3439	(91)
MIT	20.2297	20.4090	20.5177	20.5640	20.5714	20.5793	20.5793	20.5808	20.5761	20.5598	20.4339	20.1896	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2297	20.4090	20.5177	20.5640	20.5714	20.5793	20.5793	20.5808	20.5761	20.5598	20.4339	20.1896	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8857	0.7881	0.6484	0.4782	0.3365	0.2254	0.1568	0.1782	0.3073	0.5516	0.7986	0.9054	(94)
Useful gains	630.1308	672.2506	640.4892	535.6178	407.6196	269.8816	179.6187	188.0104	294.3932	453.0509	565.4734	606.2927	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	753.7551	731.2498	658.5834	538.2263	407.8736	269.8945	179.6196	188.0124	294.4927	457.9172	617.5145	745.8656	(97)
Space heating kWh	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(98a)
Space heating requirement - total per year (kWh/year)												292.0855	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												292.0855	
Space heating per m2										(98c) / (4) =		4.3982	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5604	10.4416	11.5604	11.1874	11.5604	11.1874	11.5604	11.5604	11.1874	11.5604	11.1874	11.5604	(231)
Lighting	19.0203	15.2588	13.7389	10.0657	7.7750	6.3523	7.0926	9.2193	11.9749	15.7117	17.7464	19.5489	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.9020	-25.1650	-40.7355	-51.2571	-60.2242	-57.9694	-57.0463	-51.4863	-42.0498	-30.6941	-18.2779	-13.4134	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.0531	-7.3297	-16.5280	-27.6662	-38.7205	-39.7876	-39.2248	-31.7520	-21.6853	-11.4048	-4.3848	-2.3228	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

Space heating fuel - main system 1	292.0855	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2474.1578	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.1139	(230a)
Total electricity for the above, kWh/year	136.1139	(231)
Electricity for lighting (calculated in Appendix L)	153.5048	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-708.0805	(233)
Wind generation	0.0000	(234)

Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2347.7816	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	292.0855	16.4900	48.1649	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	16.4900	407.9886	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	136.1139	16.4900	22.4452	(249)
Energy for lighting	153.5048	16.4900	25.3129	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.2208	16.4900	-76.5500	
PV Unit electricity exported	-243.8596	5.5900	-13.6318	
Total			-90.1818	(252)
Total energy cost			413.7299	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.3369	(257)
SAP value		78.3290	
SAP rating (Section 12)		78	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	292.0855	0.1601	46.7656	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2474.1578	0.1413	349.5790	(264)
Space and water heating			396.3446	(265)
Pumps, fans and electric keep-hot	136.1139	0.1387	18.8807	(267)
Energy for lighting	153.5048	0.1443	22.1555	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.2208	0.1323	-61.4360	
PV Unit electricity exported	-243.8596	0.1232	-30.0483	
Total			-91.4843	(269)
Total CO2, kg/year			345.8964	(272)
CO2 emissions per m2			5.2100	(273)
EI value			95.8397	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		66.4100 (1b)	x	2.4000 (2b)	=	159.3840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.4100						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.3840	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.8100	19.6900	25.1200	0.1400	3.5168	14.0000	351.6800	(29a)
Total net area of external elements Aum(A, m2)			44.8100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.8485			(33)
Party Wall 1			55.0200	0.0000	0.0000	20.0000	1100.4000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.4100			80.0000	5312.8000	(32d)
Party Ceiling 1			66.4100			80.0000	5312.8000	(32b)
Internal Wall 1			140.4500			9.0000	1264.0500	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13418.7300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 202.0589 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.5900	0.0700	1.1613
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	21.8000	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.5553 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 31.4038 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.0814	16.0814	15.7461	14.7402	14.5726	13.9020	13.5667	13.5667	14.2373	15.0755	15.4108	15.2432	(38)
Heat transfer coeff	47.4853	47.4853	47.1500	46.1441	45.9764	45.3058	44.9705	44.9705	45.6411	46.4794	46.8147	46.6470	(39)

Average = Sum(39)m / 12 = 46.2558

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7150	0.7150	0.7100	0.6948	0.6923	0.6822	0.6772	0.6772	0.6873	0.6999	0.7049	0.7024	(40)
HLP (average)												0.6965	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1559 (42)
Hot water usage for mixer showers

83.0050	81.7576	79.9399	76.4620	73.8955	71.0332	69.4063	71.2103	73.1878	76.2609	79.8135	82.6870	(42a)

Hot water usage for baths

26.0831	25.6958	25.1503	24.1445	23.3913	22.5562	22.1051	22.6468	23.2366	24.1302	25.1567	25.9950	(42b)

Hot water usage for other uses

36.7088	35.3739	34.0390	32.7042	31.3693	30.0344	30.0344	31.3693	32.7042	34.0390	35.3739	36.7088	(42c)

Average daily hot water use (litres/day) 134.0826 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7969	142.8273	139.1292	133.3107	128.6561	123.6239	121.5459	125.2264	129.1285	134.4302	140.3441	145.3907	(44)
Energy conte	230.9067	203.3841	213.8364	182.4956	173.1958	152.0100	146.9993	155.0565	159.2284	182.4205	199.9459	227.6467	(45)
Energy content (annual)										Total = Sum(45)m =		2227.1258	
Distribution loss (46)m = 0.15 x (45)m	34.6360	30.5076	32.0755	27.3743	25.9794	22.8015	22.0499	23.2585	23.8843	27.3631	29.9919	34.1470	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
									Total per year (kWh/year) = Sum(64)m =		2474.1578	(64)
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

93.5611	82.7855	87.8852	76.9230	74.3722	66.7865	65.6619	68.3409	69.1866	77.4394	82.7252	92.4772	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	21.7302	19.3006	15.6963	11.8831	8.8827	7.4992	8.1031	10.5328	14.1371	17.9502	20.9506	22.3341	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	281.7577	284.6815	277.3137	261.6285	241.8288	223.2199	210.7880	207.8643	215.2321	230.9172	250.7169	269.3258	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	(71)

Water heating gains (Table 5)

	125.7542	123.1928	118.1253	106.8375	99.9627	92.7591	88.2552	91.8561	96.0926	104.0853	114.8961	124.2973	(72)

Total internal gains

	522.4518	520.3846	504.3451	473.5589	443.8841	416.6880	400.3562	403.4629	418.6715	446.1625	479.7734	509.1670	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(75)
Southeast	11.8100	33.4622	0.6300	0.8270	0.7700	142.6869	(77)

Solar gains	171.2264	321.1940	487.0707	684.6820	805.1181	796.7968	769.3033	653.9832	538.3810	359.9515	212.5016	148.7415	(83)
Total gains	693.6782	841.5786	991.4157	1158.2409	1249.0022	1213.4847	1169.6595	1057.4461	957.0525	806.1140	692.2750	657.9085	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.4964	78.4964	79.0546	80.7780	81.0725	82.2725	82.8860	82.8860	81.6681	80.1952	79.6208	79.9070	
alpha	6.2331	6.2331	6.2703	6.3852	6.4048	6.4848	6.5257	6.5257	6.4445	6.3463	6.3081	6.3271	
util living area	0.9197	0.8349	0.7014	0.5179	0.3787	0.2911	0.2345	0.2636	0.3905	0.6359	0.8514	0.9346	(86)
MIT	20.6348	20.8103	20.9354	20.9903	20.9988	20.9998	21.0000	20.9999	20.9989	20.9734	20.8218	20.5957	(87)
Th 2	20.3276	20.3276	20.3320	20.3454	20.3476	20.3566	20.3610	20.3610	20.3521	20.3409	20.3365	20.3387	(88)
util rest of house	0.9069	0.8149	0.6763	0.4930	0.3548	0.2672	0.2100	0.2365	0.3598	0.6026	0.8294	0.9237	(89)
MIT 2	19.9210	20.1249	20.2669	20.3365	20.3466	20.3564	20.3610	20.3610	20.3513	20.3170	20.1505	19.8839	(90)
Living area fraction									fLA = Living area / (4) =			0.3439	(91)
MIT	20.1665	20.3606	20.4968	20.5613	20.5709	20.5777	20.5808	20.5807	20.5740	20.5428	20.3814	20.1287	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1665	20.3606	20.4968	20.5613	20.5709	20.5777	20.5808	20.5807	20.5740	20.5428	20.3814	20.1287	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9035	0.8159	0.6826	0.5012	0.3630	0.2754	0.2184	0.2458	0.3703	0.6129	0.8309	0.9199	(94)
Useful gains	626.7471	686.6584	676.6978	580.5582	453.3870	334.1970	255.4576	259.9424	354.4406	494.0662	575.2427	605.2281	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	772.4183	762.6420	702.3835	584.2461	453.8286	334.2536	255.4673	259.9631	354.8138	503.9653	645.1697	766.3484	(97)
Space heating kWh	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(98a)
Space heating requirement - total per year (kWh/year)												359.1203	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												359.1203	
Space heating per m2										(98c) / (4) =		5.4076	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
Efficiency of water heater												100.0000	(216)

(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5604	10.4416	11.5604	11.1874	11.5604	11.1874	11.5604	11.5604	11.1874	11.5604	11.1874	11.5604	(231)
Lighting	19.0203	15.2588	13.7389	10.0657	7.7750	6.3523	7.0926	9.2193	11.9749	15.7117	17.7464	19.5489	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.4219	-24.2665	-40.8039	-53.4428	-62.3485	-58.8113	-58.3661	-51.5020	-41.7727	-29.4443	-17.0276	-12.4092	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.5668	-6.7960	-16.4400	-29.7978	-41.3079	-40.8915	-40.9673	-31.7699	-21.4298	-10.5575	-3.8409	-2.0189	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	359.1203	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2474.1578	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.1139	(230a)
Total electricity for the above, kWh/year	136.1139	(231)
Electricity for lighting (calculated in Appendix L)	153.5048	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-713.0011	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2409.8957	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	359.1203	25.1600	90.3547	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	25.1600	622.4981	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	136.1139	25.1600	34.2463	(249)
Energy for lighting	153.5048	25.1600	38.6218	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.6169	25.1600	-116.8976	
PV Unit electricity exported	-248.3842	5.8100	-14.4311	
Total			-131.3287	(252)
Total energy cost			654.3921	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	359.1203	0.1596	57.3260	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2474.1578	0.1413	349.5790	(264)
Space and water heating			406.9051	(265)
Pumps, fans and electric keep-hot	136.1139	0.1387	18.8807	(267)
Energy for lighting	153.5048	0.1443	22.1555	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.6169	0.1320	-61.3475	
PV Unit electricity exported	-248.3842	0.1227	-30.4782	
Total			-91.8258	(269)
Total CO2, kg/year			356.1155	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	359.1203	1.5908	571.2751	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	1.5225	3766.8228	(278)
Space and water heating			4338.0979	(279)
Pumps, fans and electric keep-hot	136.1139	1.5128	205.9132	(281)
Energy for lighting	153.5048	1.5338	235.4508	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.6169	1.4879	-691.2826	
PV Unit electricity exported	-248.3842	0.4503	-111.8546	
Total			-803.1371	(283)
Total Primary energy kWh/year			3976.3248	(286)

SAP 10 EPC IMPROVEMENTS

Unit 371 L07_Copy

Current energy efficiency rating: C 78
Current environmental impact rating: A 96

N Solar water heating	Not applicable
U Solar photovoltaic panels	Not applicable
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 78
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£786	£786	£0
Space heating	£125	£125	£0
Water heating	£622	£622	£0
Lighting	£39	£39	£0
Generated (PV)	-£131	-£131	£0
Total cost of fuels	£655	£655	£0
Total cost of uses	£655	£655	£0
Delivered energy	36 kWh/m²	36 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	60 kWh/m²	60 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.4100 (1b)	x	2.4000 (2b)	=	159.3840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.4100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.3840	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.8100	19.6900	25.1200	0.1400	3.5168	14.0000	351.6800	(29a)
Total net area of external elements Aum(A, m2)			44.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.8485			(33)
Party Wall 1			55.0200	0.0000	0.0000	20.0000	1100.4000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.4100			80.0000	5312.8000	(32d)
Party Ceiling 1			66.4100			80.0000	5312.8000	(32b)
Internal Wall 1			140.4500			9.0000	1264.0500	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13418.7300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 202.0589 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240	
E4 Jamb	23.2000	0.0500	1.1600	
E7 Party floor between dwellings (in blocks of flats)	16.5900	0.0700	1.1613	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	21.8000	0.0000	0.0000	
E16 Corner (normal)	5.4000	0.0900	0.4860	
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.5553 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 31.4038 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.9138	15.7461	15.5785	14.7402	14.5726	13.7343	13.7343	13.5667	14.0696	14.5726	14.9079	15.2432	(38)
Heat transfer coeff	47.3176	47.1500	46.9823	46.1441	45.9764	45.1382	45.1382	44.9705	45.4735	45.9764	46.3117	46.6470	(39)
Average = Sum(39)m / 12 =												46.1022	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7125	0.7100	0.7075	0.6948	0.6923	0.6797	0.6797	0.6772	0.6847	0.6923	0.6974	0.7024	(40)
HLP (average)												0.6942	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1559 (42)
Hot water usage for mixer showers

83.0050	81.7576	79.9399	76.4620	73.8955	71.0332	69.4063	71.2103	73.1878	76.2609	79.8135	82.6870	(42a)

Hot water usage for baths

26.0831	25.6958	25.1503	24.1445	23.3913	22.5562	22.1051	22.6468	23.2366	24.1302	25.1567	25.9950	(42b)

Hot water usage for other uses

36.7088	35.3739	34.0390	32.7042	31.3693	30.0344	30.0344	31.3693	32.7042	34.0390	35.3739	36.7088	(42c)

Average daily hot water use (litres/day) 134.0826 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7969	142.8273	139.1292	133.3107	128.6561	123.6239	121.5459	125.2264	129.1285	134.4302	140.3441	145.3907	(44)
Energy conte	230.9067	203.3841	213.8364	182.4956	173.1958	152.0100	146.9993	155.0565	159.2284	182.4205	199.9459	227.6467	(45)
Energy content (annual)										Total = Sum(45)m =		2227.1258	
Distribution loss (46)m = 0.15 x (45)m	34.6360	30.5076	32.0755	27.3743	25.9794	22.8015	22.0499	23.2585	23.8843	27.3631	29.9919	34.1470	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
									Total per year (kWh/year) = Sum(64)m =			2474.1578	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	93.5611	82.7855	87.8852	76.9230	74.3722	66.7865	65.6619	68.3409	69.1866	77.4394	82.7252	92.4772	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7302	19.3006	15.6963	11.8831	8.8827	7.4992	8.1031	10.5328	14.1371	17.9502	20.9506	22.3341	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.7577	284.6815	277.3137	261.6285	241.8288	223.2199	210.7880	207.8643	215.2321	230.9172	250.7169	269.3258	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	(71)
Water heating gains (Table 5)													

	125.7542	123.1928	118.1253	106.8375	99.9627	92.7591	88.2552	91.8561	96.0926	104.0853	114.8961	124.2973	(72)
Total internal gains													
	522.4518	520.3846	504.3451	473.5589	443.8841	416.6880	400.3562	403.4629	418.6715	446.1625	479.7734	509.1670	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(75)
Southeast	11.8100	36.7938	0.6300	0.8270	0.7700	156.8932	(77)

Solar gains	188.9949	332.5911	483.3882	646.4144	767.3690	780.8797	744.9195	651.7680	539.3863	375.2206	228.3142	160.4838	(83)
Total gains	711.4468	852.9757	987.7333	1119.9732	1211.2531	1197.5676	1145.2757	1055.2309	958.0577	821.3831	708.0876	669.6508	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.7745	79.0546	79.3367	80.7780	81.0725	82.5781	82.5781	82.8860	81.9692	81.0725	80.4855	79.9070	
alpha	6.2516	6.2703	6.2891	6.3852	6.4048	6.5052	6.5052	6.5257	6.4646	6.4048	6.3657	6.3271	
util living area													
	0.9030	0.8075	0.6675	0.4956	0.3527	0.2412	0.1734	0.1960	0.3273	0.5744	0.8198	0.9213	(86)
MIT	20.6897	20.8522	20.9540	20.9930	20.9993	21.0000	21.0000	21.0000	20.9997	20.9866	20.8667	20.6491	(87)
Th 2	20.3298	20.3320	20.3342	20.3454	20.3476	20.3588	20.3588	20.3610	20.3543	20.3476	20.3432	20.3387	(88)
util rest of house													
	0.8881	0.7855	0.6410	0.4695	0.3281	0.2171	0.1481	0.1688	0.2968	0.5404	0.7950	0.9085	(89)
MIT 2	19.9885	20.1767	20.2890	20.3392	20.3471	20.3588	20.3588	20.3610	20.3541	20.3361	20.2070	19.9486	(90)
Living area fraction										fLA = Living area / (4) =		0.3439	(91)
MIT	20.2297	20.4090	20.5177	20.5640	20.5714	20.5793	20.5793	20.5808	20.5761	20.5598	20.4339	20.1896	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2297	20.4090	20.5177	20.5640	20.5714	20.5793	20.5793	20.5808	20.5761	20.5598	20.4339	20.1896	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8857	0.7881	0.6484	0.4782	0.3365	0.2254	0.1568	0.1782	0.3073	0.5516	0.7986	0.9054	(94)
Useful gains	630.1308	672.2506	640.4892	535.6178	407.6196	269.8816	179.6187	188.0104	294.3932	453.0509	565.4734	606.2927	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	753.7551	731.2498	658.5834	538.2263	407.8736	269.8945	179.6196	188.0124	294.4927	457.9172	617.5145	745.8656	(97)
Space heating kWh													
	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(98a)
Space heating requirement - total per year (kWh/year)												292.0855	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												292.0855	
Space heating per m2											(98c) / (4) =	4.3982	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5604	10.4416	11.5604	11.1874	11.5604	11.1874	11.5604	11.5604	11.1874	11.5604	11.1874	11.5604	(231)
Lighting	19.0203	15.2588	13.7389	10.0657	7.7750	6.3523	7.0926	9.2193	11.9749	15.7117	17.7464	19.5489	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.9020	-25.1650	-40.7355	-51.2571	-60.2242	-57.9694	-57.0463	-51.4863	-42.0498	-30.6941	-18.2779	-13.4134	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													

(233b)m	-3.0531	-7.3297	-16.5280	-27.6662	-38.7205	-39.7876	-39.2248	-31.7520	-21.6853	-11.4048	-4.3848	-2.3228	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	292.0855	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2474.1578	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.1139	(230a)
Total electricity for the above, kWh/year	136.1139	(231)
Electricity for lighting (calculated in Appendix L)	153.5048	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-708.0805	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2347.7816	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	292.0855	16.4900	48.1649	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	16.4900	407.9886	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	136.1139	16.4900	22.4452	(249)
Energy for lighting	153.5048	16.4900	25.3129	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.2208	16.4900	-76.5500	
PV Unit electricity exported	-243.8596	5.5900	-13.6318	
Total			-90.1818	(252)
Total energy cost			413.7299	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.3369	(257)
SAP value		78.3290	
SAP rating (Section 12)		78	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	292.0855	0.1601	46.7656	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2474.1578	0.1413	349.5790	(264)
Space and water heating			396.3446	(265)
Pumps, fans and electric keep-hot	136.1139	0.1387	18.8807	(267)
Energy for lighting	153.5048	0.1443	22.1555	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.2208	0.1323	-61.4360	
PV Unit electricity exported	-243.8596	0.1232	-30.0483	
Total			-91.4843	(269)
Total CO2, kg/year			345.8964	(272)
CO2 emissions per m2			5.2100	(273)
EI value			95.8397	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		66.4100 (1b)	x	2.4000 (2b)	=	159.3840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.4100						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.3840	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.8100	19.6900	25.1200	0.1400	3.5168	14.0000	351.6800	(29a)
Total net area of external elements Aum(A, m2)			44.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.8485			(33)
Party Wall 1			55.0200	0.0000	0.0000	20.0000	1100.4000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.4100			80.0000	5312.8000	(32d)
Party Ceiling 1			66.4100			80.0000	5312.8000	(32b)
Internal Wall 1			140.4500			9.0000	1264.0500	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13418.7300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.0589 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.5900	0.0700	1.1613
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	21.8000	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.5553 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	31.4038 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.0814	16.0814	15.7461	14.7402	14.5726	13.9020	13.5667	13.5667	14.2373	15.0755	15.4108	15.2432	(38)
Heat transfer coeff	47.4853	47.4853	47.1500	46.1441	45.9764	45.3058	44.9705	44.9705	45.6411	46.4794	46.8147	46.6470	(39)
Average = Sum(39)m / 12 =												46.2558	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7150	0.7150	0.7100	0.6948	0.6923	0.6822	0.6772	0.6772	0.6873	0.6999	0.7049	0.7024	(40)
HLP (average)												0.6965	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1559	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
83.0050	81.7576	79.9399	76.4620	73.8955	71.0332	69.4063	71.2103	73.1878	76.2609	79.8135	82.6870	(42a)

Hot water usage for baths

26.0831	25.6958	25.1503	24.1445	23.3913	22.5562	22.1051	22.6468	23.2366	24.1302	25.1567	25.9950	(42b)

Hot water usage for other uses

36.7088	35.3739	34.0390	32.7042	31.3693	30.0344	30.0344	31.3693	32.7042	34.0390	35.3739	36.7088	(42c)

Average daily hot water use (litres/day)	134.0826 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7969	142.8273	139.1292	133.3107	128.6561	123.6239	121.5459	125.2264	129.1285	134.4302	140.3441	145.3907	(44)
Energy conte	230.9067	203.3841	213.8364	182.4956	173.1958	152.0100	146.9993	155.0565	159.2284	182.4205	199.9459	227.6467	(45)
Energy content (annual)										Total = Sum(45)m =		2227.1258	
Distribution loss (46)m = 0.15 x (45)m	34.6360	30.5076	32.0755	27.3743	25.9794	22.8015	22.0499	23.2585	23.8843	27.3631	29.9919	34.1470	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)

Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
										Total per year (kWh/year) = Sum(64)m =		2474.1578	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	93.5611	82.7855	87.8852	76.9230	74.3722	66.7865	65.6619	68.3409	69.1866	77.4394	82.7252	92.4772	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.7302	19.3006	15.6963	11.8831	8.8827	7.4992	8.1031	10.5328	14.1371	17.9502	20.9506	22.3341	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	281.7577	284.6815	277.3137	261.6285	241.8288	223.2199	210.7880	207.8643	215.2321	230.9172	250.7169	269.3258	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	(71)
Water heating gains (Table 5)													
	125.7542	123.1928	118.1253	106.8375	99.9627	92.7591	88.2552	91.8561	96.0926	104.0853	114.8961	124.2973	(72)
Total internal gains													
	522.4518	520.3846	504.3451	473.5589	443.8841	416.6880	400.3562	403.4629	418.6715	446.1625	479.7734	509.1670	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(75)
Southeast	11.8100	33.4622	0.6300	0.8270	0.7700	142.6869	(77)

Solar gains	171.2264	321.1940	487.0707	684.6820	805.1181	796.7968	769.3033	653.9832	538.3810	359.9515	212.5016	148.7415	(83)
Total gains	693.6782	841.5786	991.4157	1158.2409	1249.0022	1213.4847	1169.6595	1057.4461	957.0525	806.1140	692.2750	657.9085	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.4964	78.4964	79.0546	80.7780	81.0725	82.2725	82.8860	82.8860	81.6681	80.1952	79.6208	79.9070	
alpha	6.2331	6.2331	6.2703	6.3852	6.4048	6.4848	6.5257	6.5257	6.4445	6.3463	6.3081	6.3271	
util living area													
	0.9197	0.8349	0.7014	0.5179	0.3787	0.2911	0.2345	0.2636	0.3905	0.6359	0.8514	0.9346	(86)
MIT	20.6348	20.8103	20.9354	20.9903	20.9988	20.9998	21.0000	20.9999	20.9989	20.9734	20.8218	20.5957	(87)
Th 2	20.3276	20.3276	20.3320	20.3454	20.3476	20.3566	20.3610	20.3610	20.3521	20.3409	20.3365	20.3387	(88)
util rest of house													
	0.9069	0.8149	0.6763	0.4930	0.3548	0.2672	0.2100	0.2365	0.3598	0.6026	0.8294	0.9237	(89)
MIT 2	19.9210	20.1249	20.2669	20.3365	20.3466	20.3564	20.3610	20.3610	20.3513	20.3170	20.1505	19.8839	(90)
Living area fraction										fLA = Living area / (4) =		0.3439	(91)
MIT	20.1665	20.3606	20.4968	20.5613	20.5709	20.5777	20.5808	20.5807	20.5740	20.5428	20.3814	20.1287	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1665	20.3606	20.4968	20.5613	20.5709	20.5777	20.5808	20.5807	20.5740	20.5428	20.3814	20.1287	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9035	0.8159	0.6826	0.5012	0.3630	0.2754	0.2184	0.2458	0.3703	0.6129	0.8309	0.9199	(94)
Useful gains	626.7471	686.6584	676.6978	580.5582	453.3870	334.1970	255.4576	259.9424	354.4406	494.0662	575.2427	605.2281	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	772.4183	762.6420	702.3835	584.2461	453.8286	334.2536	255.4673	259.9631	354.8138	503.9653	645.1697	766.3484	(97)
Space heating kWh													
	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(98a)
Space heating requirement - total per year (kWh/year)												359.1203	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												359.1203	
Space heating per m2											(98c) / (4) =	5.4076	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5604	10.4416	11.5604	11.1874	11.5604	11.1874	11.5604	11.5604	11.1874	11.5604	11.1874	11.5604	(231)
Lighting	19.0203	15.2588	13.7389	10.0657	7.7750	6.3523	7.0926	9.2193	11.9749	15.7117	17.7464	19.5489	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.4219	-24.2665	-40.8039	-53.4428	-62.3485	-58.8113	-58.3661	-51.5020	-41.7727	-29.4443	-17.0276	-12.4092	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.5668	-6.7960	-16.4400	-29.7978	-41.3079	-40.8915	-40.9673	-31.7699	-21.4298	-10.5575	-3.8409	-2.0189	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												359.1203	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2474.1578	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)													
mechanical ventilation fans (SFP = 0.7000)												136.1139	(230a)
Total electricity for the above, kWh/year												136.1139	(231)
Electricity for lighting (calculated in Appendix L)												153.5048	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-713.0011	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2409.8957	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	359.1203	25.1600	90.3547	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	25.1600	622.4981	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	136.1139	25.1600	34.2463	(249)
Energy for lighting	153.5048	25.1600	38.6218	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.6169	25.1600	-116.8976	
PV Unit electricity exported	-248.3842	5.8100	-14.4311	
Total			-131.3287	(252)
Total energy cost			654.3921	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	359.1203	0.1596	57.3260	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2474.1578	0.1413	349.5790	(264)
Space and water heating			406.9051	(265)
Pumps, fans and electric keep-hot	136.1139	0.1387	18.8807	(267)
Energy for lighting	153.5048	0.1443	22.1555	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.6169	0.1320	-61.3475	
PV Unit electricity exported	-248.3842	0.1227	-30.4782	
Total			-91.8258	(269)
Total CO2, kg/year			356.1155	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	359.1203	1.5908	571.2751	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	1.5225	3766.8228	(278)
Space and water heating			4338.0979	(279)
Pumps, fans and electric keep-hot	136.1139	1.5128	205.9132	(281)
Energy for lighting	153.5048	1.5338	235.4508	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.6169	1.4879	-691.2826	
PV Unit electricity exported	-248.3842	0.4503	-111.8546	
Total			-803.1371	(283)
Total Primary energy kWh/year			3976.3248	(286)

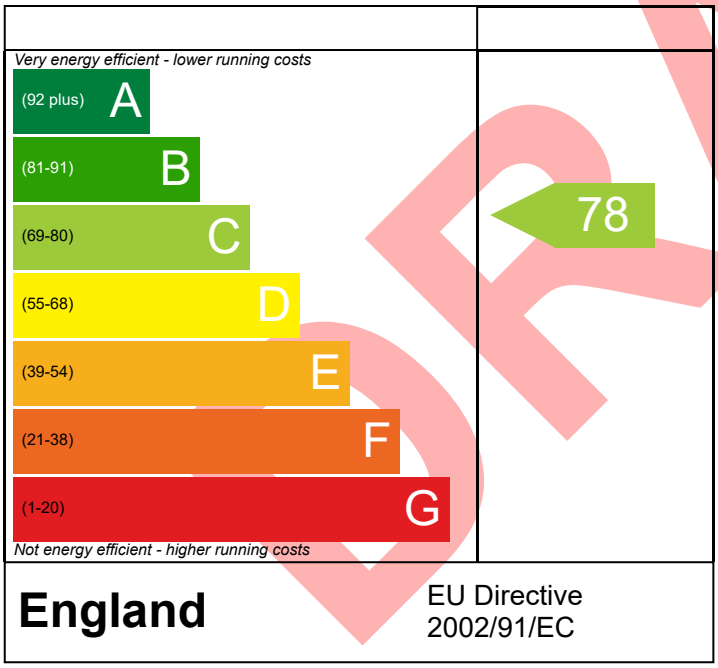
Predicted Energy Assessment

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	66.41 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

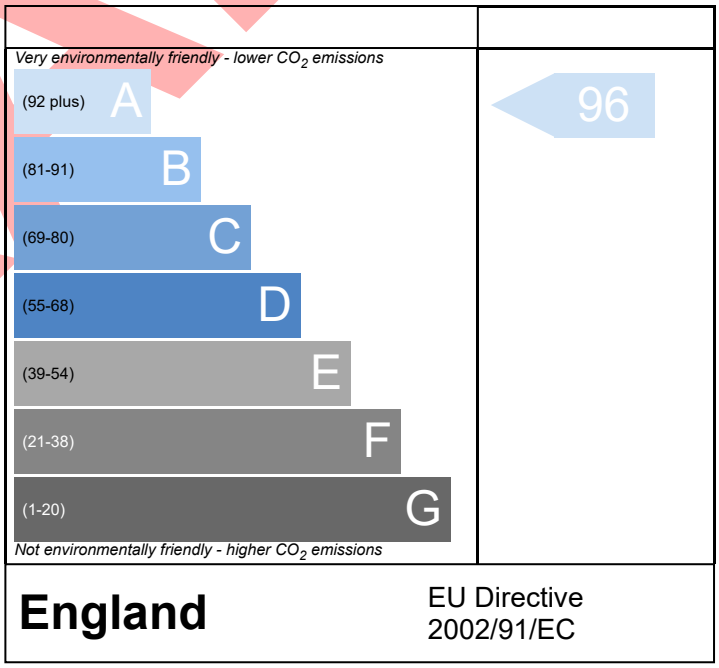
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:02

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	72 m^2
Site Reference	Unit 372 L07_Copy	Plot Reference	Unit 372 L07_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*9.41 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	4.4 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*50.9 kWh$_{PE}$/m^2*	
Dwelling primary energy	50.06 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*13.4 kWh/m^2*	
Dwelling fabric energy efficiency	12.1 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	14.87	0.14 **(!)**
Party wall: Party Wall (1)	45.09	0 **(!)**
Party wall: Party Wall (2)	22.81	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	9.29	South West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.91 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 372 L07_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 372 L07_Copy	**Prop Type Ref**	Unit 372 L07
Property			

SAP Rating	81 B	**DER**	4.40	**TER**	9.41
Environmental	96 A	**% DER < TER**			53.24
CO_2 Emissions (t/year)	0.32	**DFEE**	12.12	**TFEE**	13.41
Compliance Check	See BREL	**% DFEE < TFEE**			9.63
% DPER < TPER	1.65	**DPER**	50.06	**TPER**	50.90

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		72.4700 (1b)	x	2.4000 (2b)	=	173.9280	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.4700						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	173.9280	(5)

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2. Ventilation rate

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				m3 per hour	
Number of open chimneys			0 * 80 =	0.0000	(6a)
Number of open flues			0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire			0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler			0 * 20 =	0.0000	(6d)
Number of flues attached to other heater			0 * 35 =	0.0000	(6e)
Number of blocked chimneys			0 * 20 =	0.0000	(6f)
Number of intermittent extract fans			0 * 10 =	0.0000	(7a)
Number of passive vents			0 * 10 =	0.0000	(7b)
Number of flueless gas fires			0 * 40 =	0.0000	(7c)
			Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =			0.0000 / (5) =	0.0000	(8)
Pressure test				Yes	
Pressure Test Method				Blower Door	
Measured/design AP50				3.0000	(17)
Infiltration rate				0.1500	(18)
Number of sides sheltered				3	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												72.0000	(23c)
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			9.2900	1.2357	11.4800			(27)
External Wall 1	24.1600	9.2900	14.8700	0.1400	2.0818	14.0000	208.1800	(29a)
Total net area of external elements Aum(A, m2)			24.1600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		13.5618			(33)
Party Wall 1			45.0900	0.0000	0.0000	20.0000	901.8000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			72.4700			80.0000	5797.6000	(32d)
Party Ceiling 1			72.4700			80.0000	5797.6000	(32b)
Internal Wall 1			136.8900			9.0000	1232.0100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14393.3900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		198.6117 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	4.0000	0.0500	0.2000

E4 Jamb	13.9200	0.0500	0.6960	
E7 Party floor between dwellings (in blocks of flats)	17.9000	0.0700	1.2530	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	50.3000	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.4730 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 16.0348 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.5427	16.3759	16.2091	15.3750	15.2082	14.3742	14.3742	14.2074	14.7078	15.2082	15.5418	15.8754	(38)
Heat transfer coeff	32.5775	32.4107	32.2439	31.4099	31.2430	30.4090	30.4090	30.2422	30.7426	31.2430	31.5767	31.9103	(39)
Average = Sum(39)m / 12 =												31.3682	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4495	0.4472	0.4449	0.4334	0.4311	0.4196	0.4196	0.4173	0.4242	0.4311	0.4357	0.4403	(40)
HLP (average)												0.4328	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3046 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	86.4320	85.1331	83.2404	79.6189	76.9464	73.9660	72.2719	74.1504	76.2095	79.4095	83.1088	86.1009	(42a)
Hot water usage for baths	27.1549	26.7516	26.1837	25.1366	24.3525	23.4831	23.0135	23.5774	24.1915	25.1218	26.1905	27.0631	(42b)
Hot water usage for other uses	38.2311	36.8408	35.4506	34.0604	32.6702	31.2800	31.2800	32.6702	34.0604	35.4506	36.8408	38.2311	(42c)
Average daily hot water use (litres/day)												139.6199	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.8180	148.7256	144.8747	138.8159	133.9691	128.7290	126.5654	130.3980	134.4613	139.9819	146.1401	151.3951	(44)
Energy conte	240.4427	211.7833	222.6671	190.0321	180.3481	158.2874	153.0698	161.4599	165.8043	189.9541	208.2033	237.0481	(45)
Energy content (annual)										Total = Sum(45)m =		2319.1001	
Distribution loss (46)m = 0.15 x (45)m	36.0664	31.7675	33.4001	28.5048	27.0522	23.7431	22.9605	24.2190	24.8706	28.4931	31.2305	35.5572	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	261.4235	230.7337	243.6479	210.3361	201.3289	178.5914	174.0506	182.4407	186.1083	210.9349	228.5073	258.0289	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	261.4235	230.7337	243.6479	210.3361	201.3289	178.5914	174.0506	182.4407	186.1083	210.9349	228.5073	258.0289	(64)
										Total per year (kWh/year) = Sum(64)m =		2566.1321	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	96.7318	85.5783	90.8214	79.4289	76.7504	68.8737	67.6804	70.4701	71.3731	79.9444	85.4708	95.6031	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	138.2740	138.2740	138.2740	138.2740	138.2740	138.2740	138.2740	138.2740	138.2740	138.2740	138.2740	138.2740	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.6510	21.8948	17.8061	13.4803	10.0767	8.5072	9.1923	11.9485	16.0373	20.3630	23.7666	25.3361	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	302.9729	306.1168	298.1943	281.3281	260.0376	240.0275	226.6595	223.5156	231.4382	248.3043	269.5949	289.6050	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.1320	51.1320	51.1320	51.1320	51.1320	51.1320	51.1320	51.1320	51.1320	51.1320	51.1320	51.1320	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-92.1827	-92.1827	-92.1827	-92.1827	-92.1827	-92.1827	-92.1827	-92.1827	-92.1827	-92.1827	-92.1827	-92.1827	(71)
Water heating gains (Table 5)	130.0159	127.3486	122.0718	110.3179	103.1591	95.6580	90.9682	94.7178	99.1293	107.4521	118.7094	128.4988	(72)
Total internal gains	554.8631	552.5836	535.2955	502.3496	470.4967	441.4159	424.0433	427.4052	443.8280	473.3427	509.2942	540.6632	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	9.2900	36.7938	0.6300	0.8270	0.7700	123.4156	(79)

Solar gains	123.4156	210.2224	287.6355	356.3943	399.1913	396.3046	382.0799	350.1514	311.4484	232.3406	147.8234	105.6180	(83)
Total gains	678.2787	762.8060	822.9309	858.7439	869.6880	837.7205	806.1232	777.5566	755.2764	705.6833	657.1177	646.2813	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	122.7277	123.3594	123.9975	127.2901	127.9697	131.4796	131.4796	132.2048	130.0528	127.9697	126.6177	125.2939	
alpha	9.1818	9.2240	9.2665	9.4860	9.5313	9.7653	9.7653	9.8137	9.6702	9.5313	9.4412	9.3529	
util living area													
	0.7787	0.6774	0.5668	0.4425	0.3341	0.2323	0.1660	0.1789	0.2809	0.4603	0.6630	0.8007	(86)
MIT	20.9669	20.9894	20.9978	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9998	20.9931	20.9612	(87)
Th 2	20.5673	20.5694	20.5716	20.5822	20.5844	20.5951	20.5951	20.5972	20.5908	20.5844	20.5801	20.5758	(88)
util rest of house													
	0.7620	0.6605	0.5504	0.4272	0.3192	0.2176	0.1507	0.1632	0.2642	0.4419	0.6439	0.7847	(89)
MIT 2	20.5323	20.5586	20.5694	20.5821	20.5844	20.5951	20.5951	20.5972	20.5908	20.5842	20.5734	20.5345	(90)
Living area fraction										fLA = Living area / (4) =		0.4055	(91)
MIT	20.7086	20.7333	20.7431	20.7515	20.7529	20.7593	20.7593	20.7606	20.7567	20.7527	20.7436	20.7075	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7086	20.7333	20.7431	20.7515	20.7529	20.7593	20.7593	20.7606	20.7567	20.7527	20.7436	20.7075	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7675	0.6670	0.5570	0.4334	0.3252	0.2236	0.1569	0.1696	0.2710	0.4494	0.6514	0.7898	(94)
Useful gains	520.5932	508.7554	458.3387	372.1772	282.8365	187.2977	126.4797	131.8729	204.6452	317.1164	428.0293	510.4025	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	534.5500	513.1693	459.2532	372.2531	282.8408	187.2977	126.4797	131.8729	204.6456	317.2019	430.8195	526.7602	(97)
Space heating kWh													
	10.3839	2.9662	0.6804	0.0547	0.0032	0.0000	0.0000	0.0000	0.0000	0.0636	2.0089	12.1701	(98a)
Space heating requirement - total per year (kWh/year)												28.3311	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	10.3839	2.9662	0.6804	0.0547	0.0032	0.0000	0.0000	0.0000	0.0000	0.0636	2.0089	12.1701	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												28.3311	
Space heating per m2											(98c) / (4) =	0.3909	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	10.3839	2.9662	0.6804	0.0547	0.0032	0.0000	0.0000	0.0000	0.0000	0.0636	2.0089	12.1701	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	10.3839	2.9662	0.6804	0.0547	0.0032	0.0000	0.0000	0.0000	0.0000	0.0636	2.0089	12.1701	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	261.4235	230.7337	243.6479	210.3361	201.3289	178.5914	174.0506	182.4407	186.1083	210.9349	228.5073	258.0289	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	261.4235	230.7337	243.6479	210.3361	201.3289	178.5914	174.0506	182.4407	186.1083	210.9349	228.5073	258.0289	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.3722	12.0781	13.3722	12.9408	13.3722	12.9408	13.3722	13.3722	12.9408	13.3722	12.9408	13.3722	(231)
Lighting	21.5769	17.3098	15.5855	11.4186	8.8201	7.2061	8.0460	10.4585	13.5845	17.8236	20.1317	22.1766	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.5988	-26.3574	-42.9110	-54.1926	-63.7203	-61.3396	-60.3650	-54.4811	-44.4995	-32.4386	-19.1775	-13.9938	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.4583	-8.0264	-17.6818	-29.3192	-40.9769	-42.1009	-41.5032	-33.5967	-22.9411	-12.1079	-4.8028	-2.6573	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	28.3311	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2566.1321	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	157.4466	(230a)
Total electricity for the above, kWh/year	157.4466	(231)
Electricity for lighting (calculated in Appendix L)	174.1378	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-749.2479	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2176.7996	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	28.3311	16.4900	4.6718	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2566.1321	16.4900	423.1552	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	157.4466	16.4900	25.9629	(249)
Energy for lighting	174.1378	16.4900	28.7153	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-490.0753	16.4900	-80.8134	
PV Unit electricity exported	-259.1727	5.5900	-14.4878	
Total			-95.3012	(252)
Total energy cost			387.2041	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1866	(257)
SAP value		80.7647	
SAP rating (Section 12)		81	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	28.3311	0.1615	4.5752	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2566.1321	0.1413	362.6006	(264)
Space and water heating			367.1759	(265)
Pumps, fans and electric keep-hot	157.4466	0.1387	21.8398	(267)
Energy for lighting	174.1378	0.1443	25.1335	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-490.0753	0.1323	-64.8293	
PV Unit electricity exported	-259.1727	0.1235	-32.0041	
Total			-96.8334	(269)
Total CO2, kg/year			317.3157	(272)
CO2 emissions per m2			4.3800	(273)
EI value			96.3803	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		72.4700 (1b)	x	2.4000 (2b)	=	173.9280	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.4700						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	173.9280	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			9.2900	1.2357	11.4800			(27)
External Wall 1	24.1600	9.2900	14.8700	0.1400	2.0818	14.0000	208.1800	(29a)
Total net area of external elements Aum(A, m2)			24.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	13.5618			(33)
Party Wall 1			45.0900	0.0000	0.0000	20.0000	901.8000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			72.4700			80.0000	5797.6000	(32d)
Party Ceiling 1			72.4700			80.0000	5797.6000	(32b)
Internal Wall 1			136.8900			9.0000	1232.0100	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14393.3900 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 198.6117 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	4.0000	0.0500	0.2000
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	17.9000	0.0700	1.2530
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	50.3000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.4730 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 16.0348 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.7095	16.7095	16.3759	15.3750	15.2082	14.5410	14.2074	14.2074	14.8746	15.7086	16.0422	15.8754	(38)
Heat transfer coeff	32.7443	32.7443	32.4107	31.4099	31.2430	30.5758	30.2422	30.2422	30.9094	31.7435	32.0771	31.9103	(39)

Average = Sum(39)m / 12 = 31.5211

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4518	0.4518	0.4472	0.4334	0.4311	0.4219	0.4173	0.4173	0.4265	0.4380	0.4426	0.4403	(40)
HLP (average)												0.4350	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3046 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	86.4320	85.1331	83.2404	79.6189	76.9464	73.9660	72.2719	74.1504	76.2095	79.4095	83.1088	86.1009	(42a)
Hot water usage for baths	27.1549	26.7516	26.1837	25.1366	24.3525	23.4831	23.0135	23.5774	24.1915	25.1218	26.1905	27.0631	(42b)
Hot water usage for other uses	38.2311	36.8408	35.4506	34.0604	32.6702	31.2800	31.2800	32.6702	34.0604	35.4506	36.8408	38.2311	(42c)

Average daily hot water use (litres/day) 139.6199 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.8180	148.7256	144.8747	138.8159	133.9691	128.7290	126.5654	130.3980	134.4613	139.9819	146.1401	151.3951	(44)
Energy conte	240.4427	211.7833	222.6671	190.0321	180.3481	158.2874	153.0698	161.4599	165.8043	189.9541	208.2033	237.0481	(45)
Energy content (annual)										Total = Sum(45)m =		2319.1001	
Distribution loss (46)m = 0.15 x (45)m	36.0664	31.7675	33.4001	28.5048	27.0522	23.7431	22.9605	24.2190	24.8706	28.4931	31.2305	35.5572	(46)

Water storage loss:

Store volume 143.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)

Temperature factor from Table 2b 0.6000 (49)

Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	261.4235	230.7337	243.6479	210.3361	201.3289	178.5914	174.0506	182.4407	186.1083	210.9349	228.5073	258.0289	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	261.4235	230.7337	243.6479	210.3361	201.3289	178.5914	174.0506	182.4407	186.1083	210.9349	228.5073	258.0289	(64)
										Total per year (kWh/year) = Sum(64)m =		2566.1321	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	96.7318	85.5783	90.8214	79.4289	76.7504	68.8737	67.6804	70.4701	71.3731	79.9444	85.4708	95.6031	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	138.2740	138.2740	138.2740	138.2740	138.2740	138.2740	138.2740	138.2740	138.2740	138.2740	138.2740	138.2740	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	24.6510	21.8948	17.8061	13.4803	10.0767	8.5072	9.1923	11.9485	16.0373	20.3630	23.7666	25.3361	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	302.9729	306.1168	298.1943	281.3281	260.0376	240.0275	226.6595	223.5156	231.4382	248.3043	269.5949	289.6050	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.1320	51.1320	51.1320	51.1320	51.1320	51.1320	51.1320	51.1320	51.1320	51.1320	51.1320	51.1320	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-92.1827	-92.1827	-92.1827	-92.1827	-92.1827	-92.1827	-92.1827	-92.1827	-92.1827	-92.1827	-92.1827	-92.1827	(71)
Water heating gains (Table 5)													
	130.0159	127.3486	122.0718	110.3179	103.1591	95.6580	90.9682	94.7178	99.1293	107.4521	118.7094	128.4988	(72)
Total internal gains													
	554.8631	552.5836	535.2955	502.3496	470.4967	441.4159	424.0433	427.4052	443.8280	473.3427	509.2942	540.6632	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	9.2900	33.4622	0.6300	0.8270	0.7700	112.2406	(79)

Solar gains	112.2406	204.0551	291.7860	380.2974	421.6520	406.8428	397.1101	353.8926	313.1132	224.1729	138.1617	98.2311	(83)
Total gains	667.1037	756.6386	827.0815	882.6470	892.1487	848.2587	821.1534	781.2979	756.9413	697.5157	647.4559	638.8943	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	122.1025	122.1025	123.3594	127.2901	127.9697	130.7623	132.2048	132.2048	129.3509	125.9523	124.6424	125.2939	
alpha	9.1402	9.1402	9.2240	9.4860	9.5313	9.7175	9.8137	9.8137	9.6234	9.3968	9.3095	9.3529	
util living area													
	0.8066	0.7120	0.6012	0.4660	0.3607	0.2812	0.2247	0.2400	0.3348	0.5138	0.7043	0.8257	(86)
MIT	20.9545	20.9831	20.9961	20.9997	21.0000	21.0000	21.0000	21.0000	21.0000	20.9993	20.9877	20.9487	(87)
Th 2	20.5652	20.5652	20.5694	20.5822	20.5844	20.5929	20.5972	20.5972	20.5886	20.5780	20.5737	20.5758	(88)
util rest of house													
	0.7907	0.6952	0.5848	0.4512	0.3461	0.2665	0.2098	0.2244	0.3180	0.4947	0.6852	0.8106	(89)
MIT 2	20.5165	20.5477	20.5655	20.5819	20.5843	20.5929	20.5972	20.5972	20.5886	20.5773	20.5614	20.5206	(90)
Living area fraction										fLA = Living area / (4) =		0.4055	(91)
MIT	20.6941	20.7243	20.7401	20.7513	20.7529	20.7580	20.7606	20.7606	20.7555	20.7485	20.7343	20.6942	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6941	20.7243	20.7401	20.7513	20.7529	20.7580	20.7606	20.7606	20.7555	20.7485	20.7343	20.6942	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7955	0.7014	0.5913	0.4572	0.3520	0.2724	0.2158	0.2307	0.3249	0.5024	0.6924	0.8149	(94)
Useful gains	530.6754	530.7137	489.0769	403.5277	314.0737	231.0918	177.2361	180.2603	245.8955	350.4436	448.3302	520.6245	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	549.9130	537.8016	490.7019	403.6588	314.0834	231.0924	177.2362	180.2604	245.8988	350.7165	453.3864	542.2902	(97)
Space heating kWh													
	14.3128	4.7631	1.2090	0.0944	0.0072	0.0000	0.0000	0.0000	0.0000	0.2030	3.6404	16.1193	(98a)
Space heating requirement - total per year (kWh/year)												40.3492	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	14.3128	4.7631	1.2090	0.0944	0.0072	0.0000	0.0000	0.0000	0.0000	0.2030	3.6404	16.1193	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												40.3492	
Space heating per m2										(98c) / (4) =		0.5568	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	14.3128	4.7631	1.2090	0.0944	0.0072	0.0000	0.0000	0.0000	0.0000	0.2030	3.6404	16.1193	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	14.3128	4.7631	1.2090	0.0944	0.0072	0.0000	0.0000	0.0000	0.0000	0.2030	3.6404	16.1193	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	261.4235	230.7337	243.6479	210.3361	201.3289	178.5914	174.0506	182.4407	186.1083	210.9349	228.5073	258.0289	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	261.4235	230.7337	243.6479	210.3361	201.3289	178.5914	174.0506	182.4407	186.1083	210.9349	228.5073	258.0289	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.3722	12.0781	13.3722	12.9408	13.3722	12.9408	13.3722	13.3722	12.9408	13.3722	12.9408	13.3722	(231)

Lighting	21.5769	17.3098	15.5855	11.4186	8.8201	7.2061	8.0460	10.4585	13.5845	17.8236	20.1317	22.1766	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.0407	-25.3612	-42.9067	-56.4804	-65.9622	-62.2305	-61.7617	-54.4976	-44.2062	-31.0772	-17.8296	-12.9356	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.9357	-7.5073	-17.6654	-31.5998	-43.7208	-43.2690	-43.3470	-33.6156	-22.6708	-11.2502	-4.2523	-2.3312	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	40.3492	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2566.1321	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	157.4466	(230a)
Total electricity for the above, kWh/year	157.4466	(231)
Electricity for lighting (calculated in Appendix L)	174.1378	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-754.4546	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2183.6110	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	40.3492	25.1600	10.1519	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2566.1321	25.1600	645.6388	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	157.4466	25.1600	39.6136	(249)
Energy for lighting	174.1378	25.1600	43.8131	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-490.2896	25.1600	-123.3569	
PV Unit electricity exported	-264.1650	5.8100	-15.3480	
Total			-138.7048	(252)
Total energy cost			600.5125	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	40.3492	0.1611	6.4993	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2566.1321	0.1413	362.6006	(264)
Space and water heating			369.0999	(265)
Pumps, fans and electric keep-hot	157.4466	0.1387	21.8398	(267)
Energy for lighting	174.1378	0.1443	25.1335	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-490.2896	0.1320	-64.7052	
PV Unit electricity exported	-264.1650	0.1230	-32.4929	
Total			-97.1981	(269)
Total CO2, kg/year			318.8750	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	40.3492	1.5961	64.3999	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2566.1321	1.5225	3906.9492	(278)
Space and water heating			3971.3492	(279)
Pumps, fans and electric keep-hot	157.4466	1.5128	238.1852	(281)
Energy for lighting	174.1378	1.5338	267.0984	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-490.2896	1.4876	-729.3594	
PV Unit electricity exported	-264.1650	0.4514	-119.2484	
Total			-848.6078	(283)
Total Primary energy kWh/year			3628.0250	(286)

SAP 10 EPC IMPROVEMENTS

Unit 372 L07_Copy

Current energy efficiency rating: B 81
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: B 81
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£739	£739	£0
Space heating	£50	£50	£0
Water heating	£646	£646	£0
Lighting	£44	£44	£0
Generated (PV)	-£139	-£139	£0
Total cost of fuels	£600	£600	£0
Total cost of uses	£601	£601	£0
Delivered energy	30 kWh/m²	30 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	4 kg/m²	4 kg/m²	0 kg/m²
Primary energy	50 kWh/m²	50 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	72.4700 (1b)	x	2.4000 (2b)	=	173.9280	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.4700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	173.9280	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			9.2900	1.2357	11.4800			(27)
External Wall 1	24.1600	9.2900	14.8700	0.1400	2.0818	14.0000	208.1800	(29a)
Total net area of external elements Aum(A, m2)			24.1600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		13.5618			(33)
Party Wall 1			45.0900	0.0000	0.0000	20.0000	901.8000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			72.4700			80.0000	5797.6000	(32d)
Party Ceiling 1			72.4700			80.0000	5797.6000	(32b)
Internal Wall 1			136.8900			9.0000	1232.0100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14393.3900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		198.6117 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	4.0000	0.0500	0.2000
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	17.9000	0.0700	1.2530
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	50.3000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		2.4730 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	16.0348 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.5427	16.3759	16.2091	15.3750	15.2082	14.3742	14.3742	14.2074	14.7078	15.2082	15.5418	15.8754	(38)
Heat transfer coeff	32.5775	32.4107	32.2439	31.4099	31.2430	30.4090	30.4090	30.2422	30.7426	31.2430	31.5767	31.9103	(39)
Average = Sum(39)m / 12 =												31.3682	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4495	0.4472	0.4449	0.4334	0.4311	0.4196	0.4196	0.4173	0.4242	0.4311	0.4357	0.4403	(40)
HLP (average)												0.4328	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.3046 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
86.4320	85.1331	83.2404	79.6189	76.9464	73.9660	72.2719	74.1504	76.2095	79.4095	83.1088	86.1009	(42a)

Hot water usage for baths

27.1549	26.7516	26.1837	25.1366	24.3525	23.4831	23.0135	23.5774	24.1915	25.1218	26.1905	27.0631	(42b)

Hot water usage for other uses

38.2311	36.8408	35.4506	34.0604	32.6702	31.2800	31.2800	32.6702	34.0604	35.4506	36.8408	38.2311	(42c)

Average daily hot water use (litres/day)		139.6199 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.8180	148.7256	144.8747	138.8159	133.9691	128.7290	126.5654	130.3980	134.4613	139.9819	146.1401	151.3951	(44)
Energy conte	240.4427	211.7833	222.6671	190.0321	180.3481	158.2874	153.0698	161.4599	165.8043	189.9541	208.2033	237.0481	(45)
Energy content (annual)										Total = Sum(45)m =		2319.1001	
Distribution loss (46)m = 0.15 x (45)m	36.0664	31.7675	33.4001	28.5048	27.0522	23.7431	22.9605	24.2190	24.8706	28.4931	31.2305	35.5572	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

261.4235	230.7337	243.6479	210.3361	201.3289	178.5914	174.0506	182.4407	186.1083	210.9349	228.5073	258.0289	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

261.4235	230.7337	243.6479	210.3361	201.3289	178.5914	174.0506	182.4407	186.1083	210.9349	228.5073	258.0289	(64)
									Total per year (kWh/year) = Sum(64)m =		2566.1321	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

96.7318	85.5783	90.8214	79.4289	76.7504	68.8737	67.6804	70.4701	71.3731	79.9444	85.4708	95.6031	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	138.2740	138.2740	138.2740	138.2740	138.2740	138.2740	138.2740	138.2740	138.2740	138.2740	138.2740	138.2740	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.6510	21.8948	17.8061	13.4803	10.0767	8.5072	9.1923	11.9485	16.0373	20.3630	23.7666	25.3361	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	302.9729	306.1168	298.1943	281.3281	260.0376	240.0275	226.6595	223.5156	231.4382	248.3043	269.5949	289.6050	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.1320	51.1320	51.1320	51.1320	51.1320	51.1320	51.1320	51.1320	51.1320	51.1320	51.1320	51.1320	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-92.1827	-92.1827	-92.1827	-92.1827	-92.1827	-92.1827	-92.1827	-92.1827	-92.1827	-92.1827	-92.1827	-92.1827	(71)
Water heating gains (Table 5)	130.0159	127.3486	122.0718	110.3179	103.1591	95.6580	90.9682	94.7178	99.1293	107.4521	118.7094	128.4988	(72)
Total internal gains	554.8631	552.5836	535.2955	502.3496	470.4967	441.4159	424.0433	427.4052	443.8280	473.3427	509.2942	540.6632	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	9.2900	36.7938	0.6300	0.8270	0.7700	123.4156	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	123.4156	210.2224	287.6355	356.3943	399.1913	396.3046	382.0799	350.1514	311.4484	232.3406	147.8234	105.6180	(83)
Total gains	678.2787	762.8060	822.9309	858.7439	869.6880	837.7205	806.1232	777.5566	755.2764	705.6833	657.1177	646.2813	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	122.7277	123.3594	123.9975	127.2901	127.9697	131.4796	131.4796	132.2048	130.0528	127.9697	126.6177	125.2939	
alpha	9.1818	9.2240	9.2665	9.4860	9.5313	9.7653	9.7653	9.8137	9.6702	9.5313	9.4412	9.3529	
util living area	0.7787	0.6774	0.5668	0.4425	0.3341	0.2323	0.1660	0.1789	0.2809	0.4603	0.6630	0.8007	(86)
MIT	20.9669	20.9894	20.9978	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9998	20.9931	20.9612	(87)
Th 2	20.5673	20.5694	20.5716	20.5822	20.5844	20.5951	20.5951	20.5972	20.5908	20.5844	20.5801	20.5758	(88)
util rest of house	0.7620	0.6605	0.5504	0.4272	0.3192	0.2176	0.1507	0.1632	0.2642	0.4419	0.6439	0.7847	(89)
MIT 2	20.5323	20.5586	20.5694	20.5821	20.5844	20.5951	20.5951	20.5972	20.5908	20.5842	20.5734	20.5345	(90)
Living area fraction									fLA = Living area / (4) =			0.4055	(91)
MIT	20.7086	20.7333	20.7431	20.7515	20.7529	20.7593	20.7593	20.7606	20.7567	20.7527	20.7436	20.7075	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7086	20.7333	20.7431	20.7515	20.7529	20.7593	20.7593	20.7606	20.7567	20.7527	20.7436	20.7075	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7675	0.6670	0.5570	0.4334	0.3252	0.2236	0.1569	0.1696	0.2710	0.4494	0.6514	0.7898	(94)
Useful gains	520.5932	508.7554	458.3387	372.1772	282.8365	187.2977	126.4797	131.8729	204.6452	317.1164	428.0293	510.4025	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	534.5500	513.1693	459.2532	372.2531	282.8408	187.2977	126.4797	131.8729	204.6456	317.2019	430.8195	526.7602	(97)
Space heating kWh	10.3839	2.9662	0.6804	0.0547	0.0032	0.0000	0.0000	0.0000	0.0000	0.0636	2.0089	12.1701	(98a)
Space heating requirement - total per year (kWh/year)												28.3311	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	10.3839	2.9662	0.6804	0.0547	0.0032	0.0000	0.0000	0.0000	0.0000	0.0636	2.0089	12.1701	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												28.3311	
Space heating per m2										(98c) / (4) =		0.3909	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	10.3839	2.9662	0.6804	0.0547	0.0032	0.0000	0.0000	0.0000	0.0000	0.0636	2.0089	12.1701	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	10.3839	2.9662	0.6804	0.0547	0.0032	0.0000	0.0000	0.0000	0.0000	0.0636	2.0089	12.1701	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	261.4235	230.7337	243.6479	210.3361	201.3289	178.5914	174.0506	182.4407	186.1083	210.9349	228.5073	258.0289	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	261.4235	230.7337	243.6479	210.3361	201.3289	178.5914	174.0506	182.4407	186.1083	210.9349	228.5073	258.0289	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.3722	12.0781	13.3722	12.9408	13.3722	12.9408	13.3722	13.3722	12.9408	13.3722	12.9408	13.3722	(231)
Lighting	21.5769	17.3098	15.5855	11.4186	8.8201	7.2061	8.0460	10.4585	13.5845	17.8236	20.1317	22.1766	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.5988	-26.3574	-42.9110	-54.1926	-63.7203	-61.3396	-60.3650	-54.4811	-44.4995	-32.4386	-19.1775	-13.9938	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.4583	-8.0264	-17.6818	-29.3192	-40.9769	-42.1009	-41.5032	-33.5967	-22.9411	-12.1079	-4.8028	-2.6573	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												28.3311	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2566.1321	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	157.4466	(230a)
Total electricity for the above, kWh/year	157.4466	(231)
Electricity for lighting (calculated in Appendix L)	174.1378	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-749.2479	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2176.7996	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	28.3311	16.4900	4.6718	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2566.1321	16.4900	423.1552	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	157.4466	16.4900	25.9629	(249)
Energy for lighting	174.1378	16.4900	28.7153	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-490.0753	16.4900	-80.8134	
PV Unit electricity exported	-259.1727	5.5900	-14.4878	
Total			-95.3012	(252)
Total energy cost			387.2041	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1866	(257)
SAP value		80.7647	
SAP rating (Section 12)		81	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	28.3311	0.1615	4.5752	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2566.1321	0.1413	362.6006	(264)
Space and water heating			367.1759	(265)
Pumps, fans and electric keep-hot	157.4466	0.1387	21.8398	(267)
Energy for lighting	174.1378	0.1443	25.1335	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-490.0753	0.1323	-64.8293	
PV Unit electricity exported	-259.1727	0.1235	-32.0041	
Total			-96.8334	(269)
Total CO2, kg/year			317.3157	(272)
CO2 emissions per m2			4.3800	(273)
EI value			96.3803	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		72.4700 (1b)	x	2.4000 (2b)	=	173.9280	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.4700						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	173.9280	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			9.2900	1.2357	11.4800			(27)
External Wall 1	24.1600	9.2900	14.8700	0.1400	2.0818	14.0000	208.1800	(29a)
Total net area of external elements Aum(A, m2)			24.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	13.5618			(33)
Party Wall 1			45.0900	0.0000	0.0000	20.0000	901.8000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			72.4700			80.0000	5797.6000	(32d)
Party Ceiling 1			72.4700			80.0000	5797.6000	(32b)
Internal Wall 1			136.8900			9.0000	1232.0100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 14393.3900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.6117 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	4.0000	0.0500	0.2000
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	17.9000	0.0700	1.2530
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	50.3000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	2.4730 (36)
Point Thermal bridges	(36a) = 0.0000
Total fabric heat loss	(33) + (36) + (36a) = 16.0348 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.7095	16.7095	16.3759	15.3750	15.2082	14.5410	14.2074	14.2074	14.8746	15.7086	16.0422	15.8754	(38)
Heat transfer coeff	32.7443	32.7443	32.4107	31.4099	31.2430	30.5758	30.2422	30.2422	30.9094	31.7435	32.0771	31.9103	(39)
Average = Sum(39)m / 12 =												31.5211	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4518	0.4518	0.4472	0.4334	0.4311	0.4219	0.4173	0.4173	0.4265	0.4380	0.4426	0.4403	(40)
HLP (average)												0.4350	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3046 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	86.4320	85.1331	83.2404	79.6189	76.9464	73.9660	72.2719	74.1504	76.2095	79.4095	83.1088	86.1009	(42a)
Hot water usage for baths	27.1549	26.7516	26.1837	25.1366	24.3525	23.4831	23.0135	23.5774	24.1915	25.1218	26.1905	27.0631	(42b)
Hot water usage for other uses	38.2311	36.8408	35.4506	34.0604	32.6702	31.2800	31.2800	32.6702	34.0604	35.4506	36.8408	38.2311	(42c)
Average daily hot water use (litres/day)												139.6199	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.8180	148.7256	144.8747	138.8159	133.9691	128.7290	126.5654	130.3980	134.4613	139.9819	146.1401	151.3951	(44)
Energy conte	240.4427	211.7833	222.6671	190.0321	180.3481	158.2874	153.0698	161.4599	165.8043	189.9541	208.2033	237.0481	(45)
Energy content (annual)										Total = Sum(45)m =		2319.1001	
Distribution loss (46)m = 0.15 x (45)m	36.0664	31.7675	33.4001	28.5048	27.0522	23.7431	22.9605	24.2190	24.8706	28.4931	31.2305	35.5572	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	261.4235	230.7337	243.6479	210.3361	201.3289	178.5914	174.0506	182.4407	186.1083	210.9349	228.5073	258.0289	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	261.4235	230.7337	243.6479	210.3361	201.3289	178.5914	174.0506	182.4407	186.1083	210.9349	228.5073	258.0289	(64)
									Total per year (kWh/year) = Sum(64)m =			2566.1321	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	96.7318	85.5783	90.8214	79.4289	76.7504	68.8737	67.6804	70.4701	71.3731	79.9444	85.4708	95.6031	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	138.2740	138.2740	138.2740	138.2740	138.2740	138.2740	138.2740	138.2740	138.2740	138.2740	138.2740	138.2740	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.6510	21.8948	17.8061	13.4803	10.0767	8.5072	9.1923	11.9485	16.0373	20.3630	23.7666	25.3361	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	302.9729	306.1168	298.1943	281.3281	260.0376	240.0275	226.6595	223.5156	231.4382	248.3043	269.5949	289.6050	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.1320	51.1320	51.1320	51.1320	51.1320	51.1320	51.1320	51.1320	51.1320	51.1320	51.1320	51.1320	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-92.1827	-92.1827	-92.1827	-92.1827	-92.1827	-92.1827	-92.1827	-92.1827	-92.1827	-92.1827	-92.1827	-92.1827	(71)
Water heating gains (Table 5)	130.0159	127.3486	122.0718	110.3179	103.1591	95.6580	90.9682	94.7178	99.1293	107.4521	118.7094	128.4988	(72)
Total internal gains	554.8631	552.5836	535.2955	502.3496	470.4967	441.4159	424.0433	427.4052	443.8280	473.3427	509.2942	540.6632	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	9.2900	33.4622	0.6300	0.8270	0.7700	112.2406	(79)

Solar gains	112.2406	204.0551	291.7860	380.2974	421.6520	406.8428	397.1101	353.8926	313.1132	224.1729	138.1617	98.2311	(83)
Total gains	667.1037	756.6386	827.0815	882.6470	892.1487	848.2587	821.1534	781.2979	756.9413	697.5157	647.4559	638.8943	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	122.1025	122.1025	123.3594	127.2901	127.9697	130.7623	132.2048	132.2048	129.3509	125.9523	124.6424	125.2939	
alpha	9.1402	9.1402	9.2240	9.4860	9.5313	9.7175	9.8137	9.8137	9.6234	9.3968	9.3095	9.3529	
util living area	0.8066	0.7120	0.6012	0.4660	0.3607	0.2812	0.2247	0.2400	0.3348	0.5138	0.7043	0.8257	(86)
MIT	20.9545	20.9831	20.9961	20.9997	21.0000	21.0000	21.0000	21.0000	21.0000	20.9993	20.9877	20.9487	(87)
Th 2	20.5652	20.5652	20.5694	20.5822	20.5844	20.5929	20.5972	20.5972	20.5886	20.5780	20.5737	20.5758	(88)
util rest of house	0.7907	0.6952	0.5848	0.4512	0.3461	0.2665	0.2098	0.2244	0.3180	0.4947	0.6852	0.8106	(89)
MIT 2	20.5165	20.5477	20.5655	20.5819	20.5843	20.5929	20.5972	20.5972	20.5886	20.5773	20.5614	20.5206	(90)
Living area fraction										fLA = Living area / (4) =		0.4055	(91)
MIT	20.6941	20.7243	20.7401	20.7513	20.7529	20.7580	20.7606	20.7606	20.7555	20.7485	20.7343	20.6942	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6941	20.7243	20.7401	20.7513	20.7529	20.7580	20.7606	20.7606	20.7555	20.7485	20.7343	20.6942	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7955	0.7014	0.5913	0.4572	0.3520	0.2724	0.2158	0.2307	0.3249	0.5024	0.6924	0.8149	(94)
Useful gains	530.6754	530.7137	489.0769	403.5277	314.0737	231.0918	177.2361	180.2603	245.8955	350.4436	448.3302	520.6245	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	549.9130	537.8016	490.7019	403.6588	314.0834	231.0924	177.2362	180.2604	245.8988	350.7165	453.3864	542.2902	(97)
Space heating kWh	14.3128	4.7631	1.2090	0.0944	0.0072	0.0000	0.0000	0.0000	0.0000	0.2030	3.6404	16.1193	(98a)
Space heating requirement - total per year (kWh/year)												40.3492	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	14.3128	4.7631	1.2090	0.0944	0.0072	0.0000	0.0000	0.0000	0.0000	0.2030	3.6404	16.1193	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												40.3492	
Space heating per m2											(98c) / (4) =	0.5568	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	14.3128	4.7631	1.2090	0.0944	0.0072	0.0000	0.0000	0.0000	0.0000	0.2030	3.6404	16.1193	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													

	14.3128	4.7631	1.2090	0.0944	0.0072	0.0000	0.0000	0.0000	0.0000	0.2030	3.6404	16.1193 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	261.4235	230.7337	243.6479	210.3361	201.3289	178.5914	174.0506	182.4407	186.1083	210.9349	228.5073	258.0289 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	261.4235	230.7337	243.6479	210.3361	201.3289	178.5914	174.0506	182.4407	186.1083	210.9349	228.5073	258.0289 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	13.3722	12.0781	13.3722	12.9408	13.3722	12.9408	13.3722	13.3722	12.9408	13.3722	12.9408	13.3722 (231)
Lighting	21.5769	17.3098	15.5855	11.4186	8.8201	7.2061	8.0460	10.4585	13.5845	17.8236	20.1317	22.1766 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-15.0407	-25.3612	-42.9067	-56.4804	-65.9622	-62.2305	-61.7617	-54.4976	-44.2062	-31.0772	-17.8296	-12.9356 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.9357	-7.5073	-17.6654	-31.5998	-43.7208	-43.2690	-43.3470	-33.6156	-22.6708	-11.2502	-4.2523	-2.3312 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	40.3492 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2566.1321 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	157.4466 (230a)
Total electricity for the above, kWh/year	157.4466 (231)
Electricity for lighting (calculated in Appendix L)	174.1378 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-754.4546 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2183.6110 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	40.3492	25.1600	10.1519	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2566.1321	25.1600	645.6388	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	157.4466	25.1600	39.6136	(249)
Energy for lighting	174.1378	25.1600	43.8131	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-490.2896	25.1600	-123.3569	
PV Unit electricity exported	-264.1650	5.8100	-15.3480	
Total			-138.7048	(252)
Total energy cost			600.5125	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	40.3492	0.1611	6.4993	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2566.1321	0.1413	362.6006	(264)
Space and water heating			369.0999	(265)
Pumps, fans and electric keep-hot	157.4466	0.1387	21.8398	(267)
Energy for lighting	174.1378	0.1443	25.1335	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-490.2896	0.1320	-64.7052	
PV Unit electricity exported	-264.1650	0.1230	-32.4929	
Total			-97.1981	(269)
Total CO2, kg/year			318.8750	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	40.3492	1.5961	64.3999	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2566.1321	1.5225	3906.9492	(278)
Space and water heating			3971.3492	(279)

Pumps, fans and electric keep-hot	157.4466	1.5128	238.1852	(281)
Energy for lighting	174.1378	1.5338	267.0984	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-490.2896	1.4876	-729.3594	
PV Unit electricity exported	-264.1650	0.4514	-119.2484	
Total			-848.6078	(283)
Total Primary energy kWh/year			3628.0250	(286)

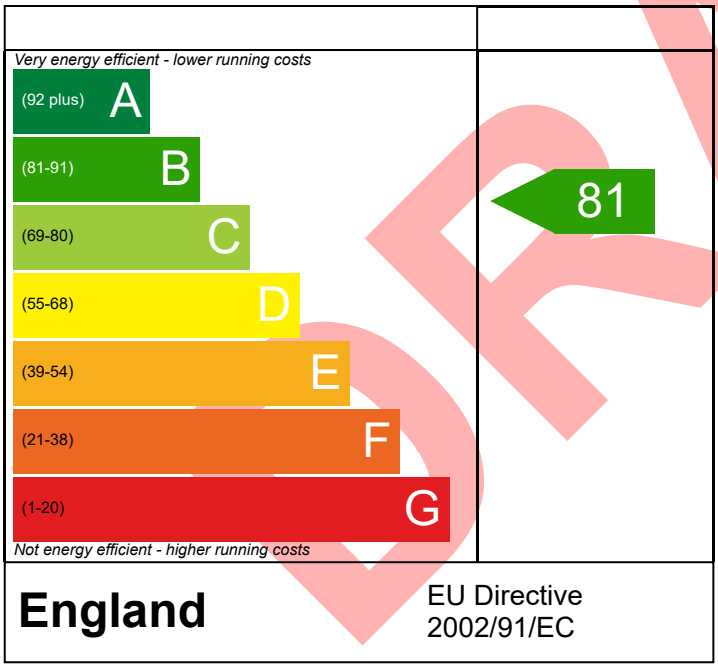
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	72.47 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

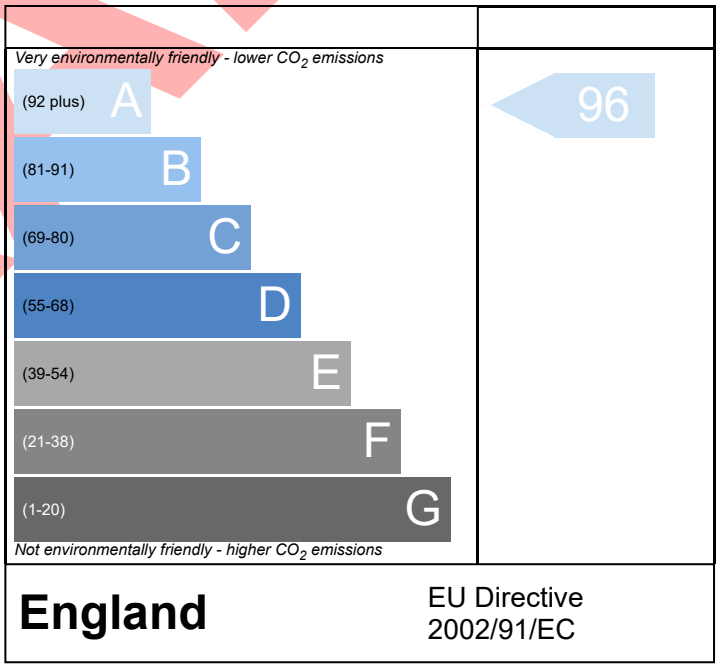
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:03

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	51 m^2
Site Reference	Unit 377 L05_Copy	Plot Reference	Unit 377 L05_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.04 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	5.4 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*60.15 kWh_{PE}/m^2*	
Dwelling primary energy	60.84 kWh_{PE}/m^2	FAIL
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*11.7 kWh/m^2*	
Dwelling fabric energy efficiency	10.6 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	10.01	0.14 **(!)**
Party wall: Party Wall (1)	46.44	0 **(!)**
Party wall: Party Wall (2)	16.06	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	6.05	South West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.66 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 377 L05_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 377 L05_Copy	**Prop Type Ref**	Unit 377 L05
Property			

SAP Rating	80 C	**DER**	5.40	**TER**	11.04
Environmental	96 A	**% DER < TER**			51.09
CO_2 Emissions (t/year)	0.28	**DFEE**	10.56	**TFEE**	11.66
Compliance Check	See BREL	**% DFEE < TFEE**			9.46
% DPER < TPER	-1.15	**DPER**	60.84	**TPER**	60.15

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.1700	(1b)	x 2.4000	(2b) =	122.8080	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.1700					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		122.8080	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.0500	1.2357	7.4762			(27)
External Wall 1	16.0600	6.0500	10.0100	0.1400	1.4014	14.0000	140.1400	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		8.8776			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			16.0600	0.0000	0.0000	20.0000	321.2000	(32)
Party Floor 1			51.1700			80.0000	4093.6000	(32d)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			79.3800			9.0000	714.4200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10291.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		201.1288 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.6000	0.0500	0.1300

E4 Jamb	9.2800	0.0500	0.4640	
E7 Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.3345 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 10.2121 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.6805	11.5628	11.4450	10.8561	10.7383	10.1494	10.1494	10.0316	10.3850	10.7383	10.9739	11.2094	(38)
Heat transfer coeff	21.8927	21.7749	21.6571	21.0682	20.9504	20.3615	20.3615	20.2437	20.5971	20.9504	21.1860	21.4216	(39)
Average = Sum(39)m / 12 =												21.0388	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4278	0.4255	0.4232	0.4117	0.4094	0.3979	0.3979	0.3956	0.4025	0.4094	0.4140	0.4186	(40)
HLP (average)												0.4112	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7246 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.0608	71.9628	70.3629	67.3017	65.0426	62.5233	61.0913	62.6791	64.4197	67.1247	70.2516	72.7809	(42a)
Hot water usage for baths	22.9731	22.6319	22.1514	21.2656	20.6022	19.8667	19.4694	19.9465	20.4660	21.2530	22.1571	22.8954	(42b)
Hot water usage for other uses	32.2915	31.1172	29.9430	28.7688	27.5945	26.4203	26.4203	27.5945	28.7688	29.9430	31.1172	32.2915	(42c)
Average daily hot water use (litres/day)												118.0151	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.3253	125.7119	122.4573	117.3360	113.2393	108.8102	106.9810	110.2201	113.6544	118.3207	123.5260	127.9677	(44)
Energy conte	203.2359	179.0121	188.2123	160.6271	152.4419	133.7949	129.3842	136.4755	140.1472	160.5600	175.9854	200.3665	(45)
Energy content (annual)										Total = Sum(45)m =		1960.2433	
Distribution loss (46)m = 0.15 x (45)m	30.4854	26.8518	28.2318	24.0941	22.8663	20.0692	19.4076	20.4713	21.0221	24.0840	26.3978	30.0550	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
										Total per year (kWh/year) = Sum(64)m =		2207.2753	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	84.3606	74.6819	79.3652	69.6517	67.4716	60.7300	59.8049	62.1628	62.8422	70.1708	74.7583	83.4065	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.5665	16.4906	13.4111	10.1530	7.5895	6.4074	6.9234	8.9993	12.0789	15.3369	17.9004	19.0825	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	224.2868	226.6142	220.7492	208.2634	192.5023	177.6891	167.7930	165.4656	171.3306	183.8164	199.5774	214.3906	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	(71)
Water heating gains (Table 5)	113.3879	111.1337	106.6737	96.7385	90.6876	84.3472	80.3829	83.5521	87.2808	94.3157	103.8310	112.1055	(72)
Total internal gains	437.8050	435.8023	422.3978	396.7187	372.3432	350.0075	336.6631	339.5808	352.2540	375.0327	402.8727	427.1425	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	6.0500	36.7938	0.6300	0.8270	0.7700	80.3729	(79)

Solar gains	80.3729	136.9048	187.3191	232.0975	259.9685	258.0886	248.8249	228.0319	202.8270	151.3090	96.2682	68.7825	(83)
Total gains	518.1779	572.7071	609.7169	628.8162	632.3117	608.0961	585.4880	567.6127	555.0810	526.3417	499.1409	495.9250	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	130.5835	131.2898	132.0039	135.6936	136.4565	140.4031	140.4031	141.2200	138.7974	136.4565	134.9393	133.4554	
alpha	9.7056	9.7527	9.8003	10.0462	10.0971	10.3602	10.3602	10.4147	10.2532	10.0971	9.9960	9.8970	
util living area													
	0.6984	0.6101	0.5147	0.4054	0.3081	0.2143	0.1530	0.1641	0.2560	0.4139	0.5887	0.7171	(86)
MIT	20.9890	20.9967	20.9993	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9999	20.9982	20.9875	(87)
Th 2	20.5874	20.5896	20.5917	20.6024	20.6045	20.6153	20.6153	20.6174	20.6110	20.6045	20.6003	20.5960	(88)
util rest of house													
	0.6823	0.5950	0.5003	0.3921	0.2950	0.2014	0.1396	0.1504	0.2416	0.3982	0.5721	0.7013	(89)
MIT 2	20.5761	20.5862	20.5910	20.6024	20.6045	20.6153	20.6153	20.6174	20.6110	20.6045	20.5985	20.5829	(90)
Living area fraction										fLA = Living area / (4) =		0.5576	(91)
MIT	20.8063	20.8150	20.8187	20.8240	20.8250	20.8298	20.8298	20.8307	20.8279	20.8250	20.8213	20.8085	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.8063	20.8150	20.8187	20.8240	20.8250	20.8298	20.8298	20.8307	20.8279	20.8250	20.8213	20.8085	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6909	0.6033	0.5083	0.3995	0.3023	0.2086	0.1471	0.1580	0.2496	0.4070	0.5813	0.7096	(94)
Useful gains	357.9877	345.5238	309.8992	251.2030	191.1725	126.8478	86.1248	89.6946	138.5746	214.2033	290.1524	351.9190	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	361.3675	346.5482	310.1013	251.2180	191.1733	126.8478	86.1248	89.6946	138.5747	214.2178	290.7000	355.7795	(97)
Space heating kWh													
	2.5146	0.6884	0.1504	0.0108	0.0006	0.0000	0.0000	0.0000	0.0000	0.0108	0.3943	2.8722	(98a)
Space heating requirement - total per year (kWh/year)												6.6421	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	2.5146	0.6884	0.1504	0.0108	0.0006	0.0000	0.0000	0.0000	0.0000	0.0108	0.3943	2.8722	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6.6421	
Space heating per m2											(98c) / (4) =	0.1298	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	2.5146	0.6884	0.1504	0.0108	0.0006	0.0000	0.0000	0.0000	0.0000	0.0108	0.3943	2.8722	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	2.5146	0.6884	0.1504	0.0108	0.0006	0.0000	0.0000	0.0000	0.0000	0.0108	0.3943	2.8722	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9074	8.0454	8.9074	8.6201	8.9074	8.6201	8.9074	8.9074	8.6201	8.9074	8.6201	8.9074	(231)
Lighting	16.2512	13.0373	11.7386	8.6002	6.6431	5.4274	6.0600	7.8770	10.2315	13.4243	15.1627	16.7028	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.1380	-19.3589	-31.6538	-40.1502	-47.3719	-45.6699	-44.9508	-40.4933	-32.9629	-23.9064	-14.0617	-10.2247	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4089	-5.5789	-12.2926	-20.4189	-28.5624	-29.3529	-28.9317	-23.3873	-15.9501	-8.4020	-3.3306	-1.8520	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	6.6421	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2207.2753	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	104.8780	(230a)
Total electricity for the above, kWh/year	104.8780	(231)
Electricity for lighting (calculated in Appendix L)	131.1561	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-543.4106	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1906.5410	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	6.6421	16.4900	1.0953	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	16.4900	363.9797	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	104.8780	16.4900	17.2944	(249)
Energy for lighting	131.1561	16.4900	21.6276	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-362.9424	16.4900	-59.8492	
PV Unit electricity exported	-180.4682	5.5900	-10.0882	
Total			-69.9374	(252)
Total energy cost			334.0596	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2505	(257)
SAP value	79.7292	
SAP rating (Section 12)	80	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6.6421	0.1617	1.0738	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2207.2753	0.1413	311.7942	(264)
Space and water heating			312.8681	(265)
Pumps, fans and electric keep-hot	104.8780	0.1387	14.5479	(267)
Energy for lighting	131.1561	0.1443	18.9299	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-362.9424	0.1322	-47.9814	
PV Unit electricity exported	-180.4682	0.1235	-22.2818	
Total			-70.2632	(269)
Total CO2, kg/year			276.0827	(272)
CO2 emissions per m2			5.4000	(273)
EI value			96.1532	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		51.1700 (1b)	x	2.4000 (2b)	=	122.8080	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.1700						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	122.8080	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.0500	1.2357	7.4762			(27)
External Wall 1	16.0600	6.0500	10.0100	0.1400	1.4014	14.0000	140.1400	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		8.8776			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			16.0600	0.0000	0.0000	20.0000	321.2000	(32)
Party Floor 1			51.1700			80.0000	4093.6000	(32d)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			79.3800			9.0000	714.4200	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 10291.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 201.1288 (35)
List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	2.6000	0.0500	0.1300
E4	Jamb	9.2800	0.0500	0.4640
E7	Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165
E18	Party wall between dwellings	5.4000	0.0600	0.3240
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.3345 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 10.2121 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.7983	11.7983	11.5628	10.8561	10.7383	10.2672	10.0316	10.0316	10.5027	11.0916	11.3272	11.2094	(38)
Heat transfer coeff	22.0105	22.0105	21.7749	21.0682	20.9504	20.4793	20.2437	20.2437	20.7149	21.3038	21.5393	21.4216	(39)

Average = Sum(39)m / 12 = 21.1467

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4301	0.4301	0.4255	0.4117	0.4094	0.4002	0.3956	0.3956	0.4048	0.4163	0.4209	0.4186	(40)
HLP (average)												0.4133	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7246 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.0608	71.9628	70.3629	67.3017	65.0426	62.5233	61.0913	62.6791	64.4197	67.1247	70.2516	72.7809	(42a)
Hot water usage for baths	22.9731	22.6319	22.1514	21.2656	20.6022	19.8667	19.4694	19.9465	20.4660	21.2530	22.1571	22.8954	(42b)
Hot water usage for other uses	32.2915	31.1172	29.9430	28.7688	27.5945	26.4203	26.4203	27.5945	28.7688	29.9430	31.1172	32.2915	(42c)

Average daily hot water use (litres/day) 118.0151 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.3253	125.7119	122.4573	117.3360	113.2393	108.8102	106.9810	110.2201	113.6544	118.3207	123.5260	127.9677	(44)
Energy conte	203.2359	179.0121	188.2123	160.6271	152.4419	133.7949	129.3842	136.4755	140.1472	160.5600	175.9854	200.3665	(45)
Energy content (annual)										Total = Sum(45)m =		1960.2433	
Distribution loss (46)m = 0.15 x (45)m	30.4854	26.8518	28.2318	24.0941	22.8663	20.0692	19.4076	20.4713	21.0221	24.0840	26.3978	30.0550	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
										Total per year (kWh/year) = Sum(64)m =		2207.2753	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	84.3606	74.6819	79.3652	69.6517	67.4716	60.7300	59.8049	62.1628	62.8422	70.1708	74.7583	83.4065	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.5665	16.4906	13.4111	10.1530	7.5895	6.4074	6.9234	8.9993	12.0789	15.3369	17.9004	19.0825	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	224.2868	226.6142	220.7492	208.2634	192.5023	177.6891	167.7930	165.4656	171.3306	183.8164	199.5774	214.3906	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	(71)
Water heating gains (Table 5)													
	113.3879	111.1337	106.6737	96.7385	90.6876	84.3472	80.3829	83.5521	87.2808	94.3157	103.8310	112.1055	(72)
Total internal gains													
	437.8050	435.8023	422.3978	396.7187	372.3432	350.0075	336.6631	339.5808	352.2540	375.0327	402.8727	427.1425	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	6.0500	33.4622	0.6300	0.8270	0.7700	73.0953	(79)

Solar gains	73.0953	132.8884	190.0221	247.6641	274.5958	264.9514	258.6131	230.4683	203.9112	145.9899	89.9762	63.9718	(83)
Total gains	510.9003	568.6907	612.4199	644.3828	646.9390	614.9590	595.2762	570.0491	556.1652	521.0226	492.8488	491.1143	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	129.8847	129.8847	131.2898	135.6936	136.4565	139.5957	141.2200	141.2200	138.0082	134.1933	132.7257	133.4554	
alpha	9.6590	9.6590	9.7527	10.0462	10.0971	10.3064	10.4147	10.4147	10.2005	9.9462	9.8484	9.8970	
util living area													
	0.7262	0.6429	0.5469	0.4283	0.3336	0.2598	0.2074	0.2202	0.3054	0.4619	0.6269	0.7426	(86)
MIT	20.9842	20.9943	20.9987	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9998	20.9964	20.9827	(87)
Th 2	20.5853	20.5853	20.5896	20.6024	20.6045	20.6131	20.6174	20.6174	20.6088	20.5981	20.5938	20.5960	(88)
util rest of house													
	0.7102	0.6276	0.5324	0.4153	0.3207	0.2469	0.1944	0.2066	0.2908	0.4455	0.6097	0.7272	(89)
MIT 2	20.5688	20.5795	20.5883	20.6023	20.6045	20.6131	20.6174	20.6174	20.6088	20.5980	20.5903	20.5778	(90)
Living area fraction										fLA = Living area / (4) =		0.5576	(91)
MIT	20.8004	20.8108	20.8171	20.8240	20.8250	20.8288	20.8307	20.8307	20.8269	20.8220	20.8168	20.8036	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.8004	20.8108	20.8171	20.8240	20.8250	20.8288	20.8307	20.8307	20.8269	20.8220	20.8168	20.8036	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7185	0.6360	0.5404	0.4225	0.3279	0.2541	0.2017	0.2142	0.2990	0.4547	0.6191	0.7352	(94)
Useful gains	367.1006	361.6592	330.9707	272.2579	212.1218	156.2330	120.0602	122.0846	166.2762	236.8899	305.1447	361.0442	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	371.9854	363.4094	331.3518	272.2854	212.1236	156.2331	120.0602	122.0846	166.2767	236.9409	306.2195	366.3847	(97)
Space heating kWh													
	3.6342	1.1761	0.2835	0.0197	0.0014	0.0000	0.0000	0.0000	0.0000	0.0379	0.7738	3.9733	(98a)
Space heating requirement - total per year (kWh/year)												9.9001	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	3.6342	1.1761	0.2835	0.0197	0.0014	0.0000	0.0000	0.0000	0.0000	0.0379	0.7738	3.9733	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9.9001	
Space heating per m2										(98c) / (4) =		0.1935	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	3.6342	1.1761	0.2835	0.0197	0.0014	0.0000	0.0000	0.0000	0.0000	0.0379	0.7738	3.9733	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	3.6342	1.1761	0.2835	0.0197	0.0014	0.0000	0.0000	0.0000	0.0000	0.0379	0.7738	3.9733	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9074	8.0454	8.9074	8.6201	8.9074	8.6201	8.9074	8.9074	8.6201	8.9074	8.6201	8.9074	(231)

Lighting	16.2512	13.0373	11.7386	8.6002	6.6431	5.4274	6.0600	7.8770	10.2315	13.4243	15.1627	16.7028	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.9890	-18.6157	-31.6465	-41.8691	-49.0676	-46.3455	-46.0104	-40.5058	-32.7427	-22.8928	-13.0639	-9.4446	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.0488	-5.2230	-12.2849	-22.0132	-30.4827	-30.1706	-30.2222	-23.4005	-15.7615	-7.8062	-2.9515	-1.6281	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	9.9001	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2207.2753	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	104.8780	(230a)
Total electricity for the above, kWh/year	104.8780	(231)
Electricity for lighting (calculated in Appendix L)	131.1561	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-547.1869	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1906.0227	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	9.9001	25.1600	2.4909	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	25.1600	555.3505	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	104.8780	25.1600	26.3873	(249)
Energy for lighting	131.1561	25.1600	32.9989	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1936	25.1600	-91.3795	
PV Unit electricity exported	-183.9933	5.8100	-10.6900	
Total			-102.0695	(252)
Total energy cost			515.1580	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	9.9001	0.1613	1.5966	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2207.2753	0.1413	311.7942	(264)
Space and water heating			313.3909	(265)
Pumps, fans and electric keep-hot	104.8780	0.1387	14.5479	(267)
Energy for lighting	131.1561	0.1443	18.9299	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1936	0.1319	-47.9013	
PV Unit electricity exported	-183.9933	0.1230	-22.6294	
Total			-70.5307	(269)
Total CO2, kg/year			276.3379	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	9.9001	1.5968	15.8083	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	1.5223	3360.2168	(278)
Space and water heating			3376.0251	(279)
Pumps, fans and electric keep-hot	104.8780	1.5128	158.6595	(281)
Energy for lighting	131.1561	1.5338	201.1716	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1936	1.4873	-540.1750	
PV Unit electricity exported	-183.9933	0.4514	-83.0493	
Total			-623.2243	(283)
Total Primary energy kWh/year			3112.6319	(286)

SAP 10 EPC IMPROVEMENTS

Unit 377 L05_Copy

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 80
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£617	£617	£0
Space heating	£29	£29	£0
Water heating	£555	£555	£0
Lighting	£33	£33	£0
Generated (PV)	-£102	-£102	£0
Total cost of fuels	£515	£515	£0
Total cost of uses	£515	£515	£0
Delivered energy	37 kWh/m²	37 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	61 kWh/m²	61 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.1700 (1b)	x	2.4000 (2b)	=	122.8080	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.1700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	122.8080	(5)

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2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor (20) = 1 - [0.075 x (19)] =		0.7750 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) =		0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.0500	1.2357	7.4762			(27)
External Wall 1	16.0600	6.0500	10.0100	0.1400	1.4014	14.0000	140.1400	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		8.8776			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			16.0600	0.0000	0.0000	20.0000	321.2000	(32)
Party Floor 1			51.1700			80.0000	4093.6000	(32d)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			79.3800			9.0000	714.4200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10291.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		201.1288 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.6000	0.0500	0.1300
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.3345 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	10.2121 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.6805	11.5628	11.4450	10.8561	10.7383	10.1494	10.1494	10.0316	10.3850	10.7383	10.9739	11.2094	(38)
Heat transfer coeff	21.8927	21.7749	21.6571	21.0682	20.9504	20.3615	20.3615	20.2437	20.5971	20.9504	21.1860	21.4216	(39)
Average = Sum(39)m / 12 =												21.0388	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4278	0.4255	0.4232	0.4117	0.4094	0.3979	0.3979	0.3956	0.4025	0.4094	0.4140	0.4186	(40)
HLP (average)												0.4112	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.7246 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.0608	71.9628	70.3629	67.3017	65.0426	62.5233	61.0913	62.6791	64.4197	67.1247	70.2516	72.7809	(42a)

Hot water usage for baths

22.9731	22.6319	22.1514	21.2656	20.6022	19.8667	19.4694	19.9465	20.4660	21.2530	22.1571	22.8954	(42b)

Hot water usage for other uses

32.2915	31.1172	29.9430	28.7688	27.5945	26.4203	26.4203	27.5945	28.7688	29.9430	31.1172	32.2915	(42c)

Average daily hot water use (litres/day)		118.0151 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.3253	125.7119	122.4573	117.3360	113.2393	108.8102	106.9810	110.2201	113.6544	118.3207	123.5260	127.9677	(44)
Energy conte	203.2359	179.0121	188.2123	160.6271	152.4419	133.7949	129.3842	136.4755	140.1472	160.5600	175.9854	200.3665	(45)
Energy content (annual)										Total = Sum(45)m =		1960.2433	

Distribution loss (46)m = 0.15 x (45)m

30.4854	26.8518	28.2318	24.0941	22.8663	20.0692	19.4076	20.4713	21.0221	24.0840	26.3978	30.0550	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
									Total per year (kWh/year) = Sum(64)m =		2207.2753	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

84.3606	74.6819	79.3652	69.6517	67.4716	60.7300	59.8049	62.1628	62.8422	70.1708	74.7583	83.4065	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.5665	16.4906	13.4111	10.1530	7.5895	6.4074	6.9234	8.9993	12.0789	15.3369	17.9004	19.0825	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	224.2868	226.6142	220.7492	208.2634	192.5023	177.6891	167.7930	165.4656	171.3306	183.8164	199.5774	214.3906	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	(71)
Water heating gains (Table 5)	113.3879	111.1337	106.6737	96.7385	90.6876	84.3472	80.3829	83.5521	87.2808	94.3157	103.8310	112.1055	(72)
Total internal gains	437.8050	435.8023	422.3978	396.7187	372.3432	350.0075	336.6631	339.5808	352.2540	375.0327	402.8727	427.1425	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	6.0500	36.7938	0.6300	0.8270	0.7700	80.3729	(79)

Solar gains	80.3729	136.9048	187.3191	232.0975	259.9685	258.0886	248.8249	228.0319	202.8270	151.3090	96.2682	68.7825	(83)
Total gains	518.1779	572.7071	609.7169	628.8162	632.3117	608.0961	585.4880	567.6127	555.0810	526.3417	499.1409	495.9250	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	130.5835	131.2898	132.0039	135.6936	136.4565	140.4031	140.4031	141.2200	138.7974	136.4565	134.9393	133.4554	
alpha	9.7056	9.7527	9.8003	10.0462	10.0971	10.3602	10.3602	10.4147	10.2532	10.0971	9.9960	9.8970	
util living area	0.6984	0.6101	0.5147	0.4054	0.3081	0.2143	0.1530	0.1641	0.2560	0.4139	0.5887	0.7171	(86)
MIT	20.9890	20.9967	20.9993	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9999	20.9982	20.9875	(87)
Th 2	20.5874	20.5896	20.5917	20.6024	20.6045	20.6153	20.6153	20.6174	20.6110	20.6045	20.6003	20.5960	(88)
util rest of house	0.6823	0.5950	0.5003	0.3921	0.2950	0.2014	0.1396	0.1504	0.2416	0.3982	0.5721	0.7013	(89)
MIT 2	20.5761	20.5862	20.5910	20.6024	20.6045	20.6153	20.6153	20.6174	20.6110	20.6045	20.5985	20.5829	(90)
Living area fraction									fLA = Living area / (4) =			0.5576	(91)
MIT	20.8063	20.8150	20.8187	20.8240	20.8250	20.8298	20.8298	20.8307	20.8279	20.8250	20.8213	20.8085	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.8063	20.8150	20.8187	20.8240	20.8250	20.8298	20.8298	20.8307	20.8279	20.8250	20.8213	20.8085	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6909	0.6033	0.5083	0.3995	0.3023	0.2086	0.1471	0.1580	0.2496	0.4070	0.5813	0.7096	(94)
Useful gains	357.9877	345.5238	309.8992	251.2030	191.1725	126.8478	86.1248	89.6946	138.5746	214.2033	290.1524	351.9190	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	361.3675	346.5482	310.1013	251.2180	191.1733	126.8478	86.1248	89.6946	138.5747	214.2178	290.7000	355.7795	(97)
Space heating kWh	2.5146	0.6884	0.1504	0.0108	0.0006	0.0000	0.0000	0.0000	0.0000	0.0108	0.3943	2.8722	(98a)
Space heating requirement - total per year (kWh/year)												6.6421	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	2.5146	0.6884	0.1504	0.0108	0.0006	0.0000	0.0000	0.0000	0.0000	0.0108	0.3943	2.8722	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6.6421	
Space heating per m2											(98c) / (4) =	0.1298	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	2.5146	0.6884	0.1504	0.0108	0.0006	0.0000	0.0000	0.0000	0.0000	0.0108	0.3943	2.8722	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	2.5146	0.6884	0.1504	0.0108	0.0006	0.0000	0.0000	0.0000	0.0000	0.0108	0.3943	2.8722	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9074	8.0454	8.9074	8.6201	8.9074	8.6201	8.9074	8.9074	8.6201	8.9074	8.6201	8.9074	(231)
Lighting	16.2512	13.0373	11.7386	8.6002	6.6431	5.4274	6.0600	7.8770	10.2315	13.4243	15.1627	16.7028	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.1380	-19.3589	-31.6538	-40.1502	-47.3719	-45.6699	-44.9508	-40.4933	-32.9629	-23.9064	-14.0617	-10.2247	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4089	-5.5789	-12.2926	-20.4189	-28.5624	-29.3529	-28.9317	-23.3873	-15.9501	-8.4020	-3.3306	-1.8520	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												6.6421	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2207.2753	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	104.8780	(230a)
Total electricity for the above, kWh/year	104.8780	(231)
Electricity for lighting (calculated in Appendix L)	131.1561	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-543.4106	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1906.5410	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	6.6421	16.4900	1.0953	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	16.4900	363.9797	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	104.8780	16.4900	17.2944	(249)
Energy for lighting	131.1561	16.4900	21.6276	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-362.9424	16.4900	-59.8492	
PV Unit electricity exported	-180.4682	5.5900	-10.0882	
Total			-69.9374	(252)
Total energy cost			334.0596	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2505	(257)
SAP value		79.7292	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6.6421	0.1617	1.0738	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2207.2753	0.1413	311.7942	(264)
Space and water heating			312.8681	(265)
Pumps, fans and electric keep-hot	104.8780	0.1387	14.5479	(267)
Energy for lighting	131.1561	0.1443	18.9299	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-362.9424	0.1322	-47.9814	
PV Unit electricity exported	-180.4682	0.1235	-22.2818	
Total			-70.2632	(269)
Total CO2, kg/year			276.0827	(272)
CO2 emissions per m2			5.4000	(273)
EI value			96.1532	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		51.1700	(1b)	x 2.4000	(2b) =	122.8080	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.1700						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		122.8080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.0500	1.2357	7.4762			(27)
External Wall 1	16.0600	6.0500	10.0100	0.1400	1.4014	14.0000	140.1400	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	8.8776			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			16.0600	0.0000	0.0000	20.0000	321.2000	(32)
Party Floor 1			51.1700			80.0000	4093.6000	(32d)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			79.3800			9.0000	714.4200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10291.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		201.1288 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.6000	0.0500	0.1300
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.3345 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	10.2121 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.7983	11.7983	11.5628	10.8561	10.7383	10.2672	10.0316	10.0316	10.5027	11.0916	11.3272	11.2094	(38)
Heat transfer coeff	22.0105	22.0105	21.7749	21.0682	20.9504	20.4793	20.2437	20.2437	20.7149	21.3038	21.5393	21.4216	(39)
Average = Sum(39)m / 12 =												21.1467	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4301	0.4301	0.4255	0.4117	0.4094	0.4002	0.3956	0.3956	0.4048	0.4163	0.4209	0.4186	(40)
HLP (average)												0.4133	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.7246 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.0608	71.9628	70.3629	67.3017	65.0426	62.5233	61.0913	62.6791	64.4197	67.1247	70.2516	72.7809	(42a)

Hot water usage for baths

22.9731	22.6319	22.1514	21.2656	20.6022	19.8667	19.4694	19.9465	20.4660	21.2530	22.1571	22.8954	(42b)

Hot water usage for other uses

32.2915	31.1172	29.9430	28.7688	27.5945	26.4203	26.4203	27.5945	28.7688	29.9430	31.1172	32.2915	(42c)

Average daily hot water use (litres/day)		118.0151 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.3253	125.7119	122.4573	117.3360	113.2393	108.8102	106.9810	110.2201	113.6544	118.3207	123.5260	127.9677	(44)
Energy conte	203.2359	179.0121	188.2123	160.6271	152.4419	133.7949	129.3842	136.4755	140.1472	160.5600	175.9854	200.3665	(45)
Energy content (annual)										Total = Sum(45)m =		1960.2433	

Distribution loss (46)m = 0.15 x (45)m

30.4854	26.8518	28.2318	24.0941	22.8663	20.0692	19.4076	20.4713	21.0221	24.0840	26.3978	30.0550	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
									Total per year (kWh/year) = Sum(64)m =			2207.2753	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	84.3606	74.6819	79.3652	69.6517	67.4716	60.7300	59.8049	62.1628	62.8422	70.1708	74.7583	83.4065	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.5665	16.4906	13.4111	10.1530	7.5895	6.4074	6.9234	8.9993	12.0789	15.3369	17.9004	19.0825	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	224.2868	226.6142	220.7492	208.2634	192.5023	177.6891	167.7930	165.4656	171.3306	183.8164	199.5774	214.3906	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	(71)
Water heating gains (Table 5)	113.3879	111.1337	106.6737	96.7385	90.6876	84.3472	80.3829	83.5521	87.2808	94.3157	103.8310	112.1055	(72)
Total internal gains	437.8050	435.8023	422.3978	396.7187	372.3432	350.0075	336.6631	339.5808	352.2540	375.0327	402.8727	427.1425	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	6.0500	33.4622	0.6300	0.8270	0.7700	73.0953	(79)

Solar gains	73.0953	132.8884	190.0221	247.6641	274.5958	264.9514	258.6131	230.4683	203.9112	145.9899	89.9762	63.9718	(83)
Total gains	510.9003	568.6907	612.4199	644.3828	646.9390	614.9590	595.2762	570.0491	556.1652	521.0226	492.8488	491.1143	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	129.8847	129.8847	131.2898	135.6936	136.4565	139.5957	141.2200	141.2200	138.0082	134.1933	132.7257	133.4554	
alpha	9.6590	9.6590	9.7527	10.0462	10.0971	10.3064	10.4147	10.4147	10.2005	9.9462	9.8484	9.8970	
util living area	0.7262	0.6429	0.5469	0.4283	0.3336	0.2598	0.2074	0.2202	0.3054	0.4619	0.6269	0.7426	(86)
MIT	20.9842	20.9943	20.9987	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9998	20.9964	20.9827	(87)
Th 2	20.5853	20.5853	20.5896	20.6024	20.6045	20.6131	20.6174	20.6174	20.6088	20.5981	20.5938	20.5960	(88)
util rest of house	0.7102	0.6276	0.5324	0.4153	0.3207	0.2469	0.1944	0.2066	0.2908	0.4455	0.6097	0.7272	(89)
MIT 2	20.5688	20.5795	20.5883	20.6023	20.6045	20.6131	20.6174	20.6174	20.6088	20.5980	20.5903	20.5778	(90)
Living area fraction										fLA = Living area / (4) =		0.5576	(91)
MIT	20.8004	20.8108	20.8171	20.8240	20.8250	20.8288	20.8307	20.8307	20.8269	20.8220	20.8168	20.8036	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.8004	20.8108	20.8171	20.8240	20.8250	20.8288	20.8307	20.8307	20.8269	20.8220	20.8168	20.8036	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7185	0.6360	0.5404	0.4225	0.3279	0.2541	0.2017	0.2142	0.2990	0.4547	0.6191	0.7352	(94)
Useful gains	367.1006	361.6592	330.9707	272.2579	212.1218	156.2330	120.0602	122.0846	166.2762	236.8899	305.1447	361.0442	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	371.9854	363.4094	331.3518	272.2854	212.1236	156.2331	120.0602	122.0846	166.2767	236.9409	306.2195	366.3847	(97)
Space heating kWh	3.6342	1.1761	0.2835	0.0197	0.0014	0.0000	0.0000	0.0000	0.0000	0.0379	0.7738	3.9733	(98a)
Space heating requirement - total per year (kWh/year)												9.9001	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	3.6342	1.1761	0.2835	0.0197	0.0014	0.0000	0.0000	0.0000	0.0000	0.0379	0.7738	3.9733	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9.9001	
Space heating per m2											(98c) / (4) =	0.1935	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	3.6342	1.1761	0.2835	0.0197	0.0014	0.0000	0.0000	0.0000	0.0000	0.0379	0.7738	3.9733	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													

	3.6342	1.1761	0.2835	0.0197	0.0014	0.0000	0.0000	0.0000	0.0000	0.0379	0.7738	3.9733 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	8.9074	8.0454	8.9074	8.6201	8.9074	8.6201	8.9074	8.9074	8.6201	8.9074	8.6201	8.9074 (231)
Lighting	16.2512	13.0373	11.7386	8.6002	6.6431	5.4274	6.0600	7.8770	10.2315	13.4243	15.1627	16.7028 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-10.9890	-18.6157	-31.6465	-41.8691	-49.0676	-46.3455	-46.0104	-40.5058	-32.7427	-22.8928	-13.0639	-9.4446 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.0488	-5.2230	-12.2849	-22.0132	-30.4827	-30.1706	-30.2222	-23.4005	-15.7615	-7.8062	-2.9515	-1.6281 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	9.9001 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2207.2753 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	104.8780 (230a)
Total electricity for the above, kWh/year	104.8780 (231)
Electricity for lighting (calculated in Appendix L)	131.1561 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-547.1869 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1906.0227 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	9.9001	25.1600	2.4909	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	25.1600	555.3505	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	104.8780	25.1600	26.3873	(249)
Energy for lighting	131.1561	25.1600	32.9989	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1936	25.1600	-91.3795	
PV Unit electricity exported	-183.9933	5.8100	-10.6900	
Total			-102.0695	(252)
Total energy cost			515.1580	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	9.9001	0.1613	1.5966	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2207.2753	0.1413	311.7942	(264)
Space and water heating			313.3909	(265)
Pumps, fans and electric keep-hot	104.8780	0.1387	14.5479	(267)
Energy for lighting	131.1561	0.1443	18.9299	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1936	0.1319	-47.9013	
PV Unit electricity exported	-183.9933	0.1230	-22.6294	
Total			-70.5307	(269)
Total CO2, kg/year			276.3379	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	9.9001	1.5968	15.8083	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	1.5223	3360.2168	(278)
Space and water heating			3376.0251	(279)

Pumps, fans and electric keep-hot	104.8780	1.5128	158.6595	(281)
Energy for lighting	131.1561	1.5338	201.1716	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1936	1.4873	-540.1750	
PV Unit electricity exported	-183.9933	0.4514	-83.0493	
Total			-623.2243	(283)
Total Primary energy kWh/year			3112.6319	(286)

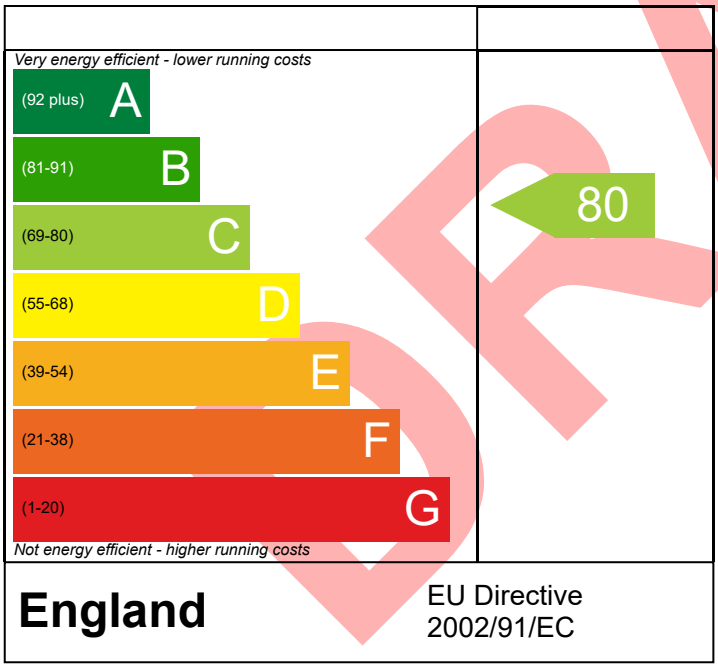
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	51.17 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

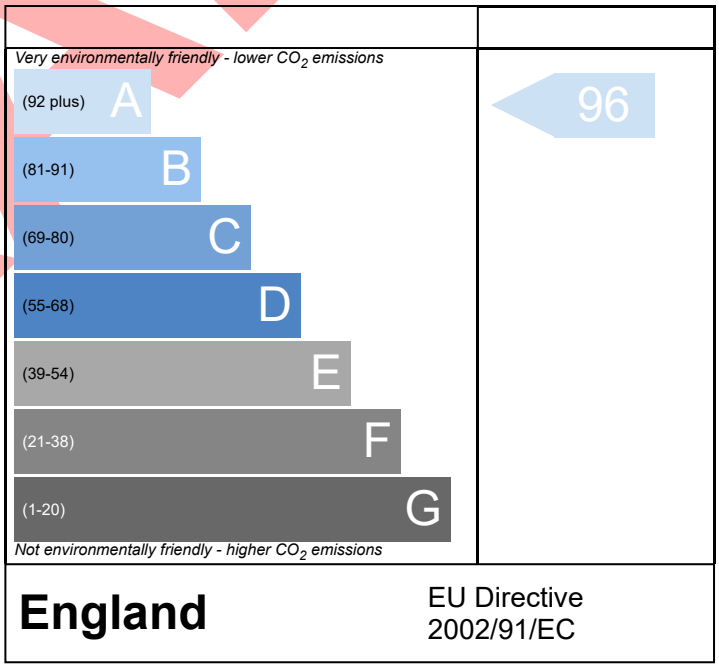
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:05

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	46 m^2
Site Reference	Unit 378 L05_Copy	Plot Reference	Unit 378 L05_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.95 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	5.83 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*65.03 kWh$_{PE}$/m^2*	
Dwelling primary energy	65.31 kWh$_{PE}$/m^2	FAIL
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*13.5 kWh/m^2*	
Dwelling fabric energy efficiency	12.5 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	8.18	0.14 **(!)**
Party wall: Party Wall (1)	23.22	0 **(!)**
Party wall: Party Wall (2)	39.28	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	7.88	South West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.59 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 378 L05_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 378 L05_Copy	**Prop Type Ref**	Unit 378 L05
Property			

SAP Rating	79 C	**DER**	5.83	**TER**	11.95
Environmental	96 A	**% DER < TER**			51.21
CO_2 Emissions (t/year)	0.27	**DFEE**	12.53	**TFEE**	13.52
Compliance Check	See BREL	**% DFEE < TFEE**			7.35
% DPER < TPER	-0.42	**DPER**	65.31	**TPER**	65.03

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.9900 (1b)	x	2.4000 (2b)	=	110.3760	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.9900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	110.3760	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	16.0600	7.8800	8.1800	0.1400	1.1452	14.0000	114.5200	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.8828			(33)
Party Wall 1			23.2200	0.0000	0.0000	20.0000	464.4000	(32)
Wall to corridor			39.2800	0.0000	0.0000	20.0000	785.6000	(32)
Party Floor 1			45.9900			80.0000	3679.2000	(32d)
Party Ceiling 1			45.9900			80.0000	3679.2000	(32b)
Internal Wall 1			66.6300			9.0000	599.6700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9322.5900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.7091 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695

E4 Jamb	9.2800	0.0500	0.4640	
E7 Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165	
E18 Party wall between dwellings	2.7000	0.0600	0.1620	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.2120 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 12.0948 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	10.4981	10.3922	10.2864	9.7571	9.6512	9.1220	9.1220	9.0161	9.3337	9.6512	9.8630	10.0747	(38)
Heat transfer coeff	22.5929	22.4871	22.3812	21.8519	21.7461	21.2168	21.2168	21.1109	21.4285	21.7461	21.9578	22.1695	(39)

Average = Sum(39)m / 12 = 21.8255

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4913	0.4890	0.4867	0.4751	0.4728	0.4613	0.4613	0.4590	0.4659	0.4728	0.4774	0.4821	(40)
HLP (average)												0.4746	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.5731 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	69.5673	68.5219	66.9984	64.0836	61.9325	59.5337	58.1702	59.6821	61.3394	63.9151	66.8925	69.3008	(42a)
Hot water usage for baths	21.8805	21.5555	21.0979	20.2542	19.6224	18.9219	18.5435	18.9979	19.4926	20.2422	21.1034	21.8065	(42b)
Hot water usage for other uses	30.7397	29.6219	28.5041	27.3863	26.2684	25.1506	25.1506	26.2684	27.3863	28.5041	29.6219	30.7397	(42c)

Average daily hot water use (litres/day) 112.3706 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	122.1875	119.6993	116.6004	111.7240	107.8234	103.6062	101.8643	104.9484	108.2183	112.6614	117.6177	121.8470	(44)
Energy conte	193.5151	170.4502	179.2105	152.9446	145.1510	127.3959	123.1960	129.9480	133.4440	152.8804	167.5680	190.7830	(45)

Energy content (annual) Total = Sum(45)m = 1866.4867

Distribution loss (46)m = 0.15 x (45)m	29.0273	25.5675	26.8816	22.9417	21.7726	19.1094	18.4794	19.4922	20.0166	22.9321	25.1352	28.6174	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(64)

Total per year (kWh/year) = Sum(64)m = 2113.5187 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	81.1284	71.8350	76.3721	67.0973	65.0473	58.6023	57.7473	59.9924	60.6133	67.6174	71.9596	80.2200	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.8429	14.0716	11.4438	8.6637	6.4762	5.4675	5.9078	7.6792	10.3070	13.0871	15.2745	16.2833	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	204.2328	206.3521	201.0115	189.6421	175.2902	161.8015	152.7902	150.6709	156.0115	167.3809	181.7328	195.2215	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	(71)
Water heating gains (Table 5)	109.0436	106.8973	102.6507	93.1907	87.4292	81.3921	77.6173	80.6349	84.1852	90.8836	99.9438	107.8225	(72)
Total internal gains	406.5918	404.7935	392.5785	368.9690	346.6682	326.1336	313.7879	316.4575	327.9762	348.8241	374.4237	396.7998	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(79)

Solar gains	104.6841	178.3157	243.9793	302.3022	338.6036	336.1550	324.0893	297.0068	264.1780	197.0768	125.3874	89.5877	(83)
Total gains	511.2759	583.1092	636.5578	671.2711	685.2718	662.2886	637.8772	613.4643	592.1541	545.9009	499.8110	486.3875	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.6202	115.1598	115.7045	118.5070	119.0839	122.0546	122.0546	122.6666	120.8487	119.0839	117.9357	116.8094	
alpha	8.6413	8.6773	8.7136	8.9005	8.9389	9.1370	9.1370	9.1778	9.0566	8.9389	8.8624	8.7873	
util living area													
	0.7232	0.6171	0.5091	0.3938	0.2951	0.2050	0.1464	0.1583	0.2497	0.4142	0.6076	0.7472	(86)
MIT	20.9759	20.9929	20.9986	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9998	20.9952	20.9711	(87)
Th 2	20.5289	20.5310	20.5331	20.5437	20.5458	20.5564	20.5564	20.5585	20.5522	20.5458	20.5415	20.5373	(88)
util rest of house													
	0.7052	0.5998	0.4929	0.3790	0.2807	0.1908	0.1316	0.1431	0.2335	0.3961	0.5882	0.7296	(89)
MIT 2	20.5038	20.5238	20.5317	20.5436	20.5458	20.5564	20.5564	20.5585	20.5522	20.5457	20.5369	20.5072	(90)
Living area fraction										fLA = Living area / (4) =		0.5849	(91)
MIT	20.7799	20.7982	20.8048	20.8105	20.8115	20.8159	20.8159	20.8167	20.8141	20.8113	20.8049	20.7786	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7799	20.7982	20.8048	20.8105	20.8115	20.8159	20.8159	20.8167	20.8141	20.8113	20.8049	20.7786	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7148	0.6097	0.5023	0.3877	0.2891	0.1991	0.1402	0.1520	0.2430	0.4067	0.5994	0.7388	(94)
Useful gains	365.4773	355.5043	319.7589	260.2320	198.1363	131.8807	89.4472	93.2417	143.8729	222.0136	299.5858	359.3539	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	372.3303	357.5044	320.1584	260.2666	198.1384	131.8808	89.4472	93.2417	143.8732	222.0560	300.9299	367.5386	(97)
Space heating kWh													
	5.0986	1.3441	0.2972	0.0250	0.0016	0.0000	0.0000	0.0000	0.0000	0.0316	0.9678	6.0895	(98a)
Space heating requirement - total per year (kWh/year)												13.8553	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	5.0986	1.3441	0.2972	0.0250	0.0016	0.0000	0.0000	0.0000	0.0000	0.0316	0.9678	6.0895	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												13.8553	
Space heating per m2											(98c) / (4) =	0.3013	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	5.0986	1.3441	0.2972	0.0250	0.0016	0.0000	0.0000	0.0000	0.0000	0.0316	0.9678	6.0895	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	5.0986	1.3441	0.2972	0.0250	0.0016	0.0000	0.0000	0.0000	0.0000	0.0316	0.9678	6.0895	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.0057	7.2310	8.0057	7.7475	8.0057	7.7475	8.0057	8.0057	7.7475	8.0057	7.7475	8.0057	(231)
Lighting	13.8672	11.1248	10.0167	7.3386	5.6686	4.6313	5.1711	6.7215	8.7306	11.4550	12.9384	14.2526	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.9014	-17.4086	-28.5096	-36.2296	-42.8123	-41.3020	-40.6525	-36.5864	-29.7361	-21.5179	-12.6331	-9.1811	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.1026	-4.8842	-10.7759	-17.9155	-25.0683	-25.7639	-25.3939	-20.5190	-13.9892	-7.3639	-2.9146	-1.6147	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	13.8553	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2113.5187	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	94.2611	(230a)
Total electricity for the above, kWh/year	94.2611	(231)
Electricity for lighting (calculated in Appendix L)	111.9165	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-485.7761	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1847.7754	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	13.8553	16.4900	2.2847	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2113.5187	16.4900	348.5192	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	94.2611	16.4900	15.5437	(249)
Energy for lighting	111.9165	16.4900	18.4550	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-327.4705	16.4900	-53.9999	
PV Unit electricity exported	-158.3056	5.5900	-8.8493	
Total			-62.8492	(252)
Total energy cost			321.9535	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2738	(257)
SAP value		79.3517	
SAP rating (Section 12)		79	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	13.8553	0.1616	2.2384	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2113.5187	0.1412	298.5203	(264)
Space and water heating			300.7587	(265)
Pumps, fans and electric keep-hot	94.2611	0.1387	13.0752	(267)
Energy for lighting	111.9165	0.1443	16.1530	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-327.4705	0.1322	-43.2810	
PV Unit electricity exported	-158.3056	0.1234	-19.5419	
Total			-62.8230	(269)
Total CO2, kg/year			267.1640	(272)
CO2 emissions per m2			5.8100	(273)
EI value			96.0655	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		45.9900 (1b)	x	2.4000 (2b)	=	110.3760	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.9900						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	110.3760	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	16.0600	7.8800	8.1800	0.1400	1.1452	14.0000	114.5200	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.8828			(33)
Party Wall 1			23.2200	0.0000	0.0000	20.0000	464.4000	(32)
Wall to corridor			39.2800	0.0000	0.0000	20.0000	785.6000	(32)
Party Floor 1			45.9900			80.0000	3679.2000	(32d)
Party Ceiling 1			45.9900			80.0000	3679.2000	(32b)
Internal Wall 1			66.6300			9.0000	599.6700	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9322.5900 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 202.7091 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4	Jamb	9.2800	0.0500	0.4640
E7	Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165
E18	Party wall between dwellings	2.7000	0.0600	0.1620
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.2120 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 12.0948 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	10.6040	10.6040	10.3922	9.7571	9.6512	9.2278	9.0161	9.0161	9.4395	9.9688	10.1805	10.0747	(38)
Heat transfer coeff	22.6988	22.6988	22.4871	21.8519	21.7461	21.3227	21.1109	21.1109	21.5344	22.0637	22.2754	22.1695	(39)

Average = Sum(39)m / 12 = 21.9225

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4936	0.4936	0.4890	0.4751	0.4728	0.4636	0.4590	0.4590	0.4682	0.4797	0.4844	0.4821	(40)
HLP (average)												0.4767	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.5731 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	69.5673	68.5219	66.9984	64.0836	61.9325	59.5337	58.1702	59.6821	61.3394	63.9151	66.8925	69.3008	(42a)
Hot water usage for baths	21.8805	21.5555	21.0979	20.2542	19.6224	18.9219	18.5435	18.9979	19.4926	20.2422	21.1034	21.8065	(42b)
Hot water usage for other uses	30.7397	29.6219	28.5041	27.3863	26.2684	25.1506	25.1506	26.2684	27.3863	28.5041	29.6219	30.7397	(42c)

Average daily hot water use (litres/day) 112.3706 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	122.1875	119.6993	116.6004	111.7240	107.8234	103.6062	101.8643	104.9484	108.2183	112.6614	117.6177	121.8470	(44)
Energy conte	193.5151	170.4502	179.2105	152.9446	145.1510	127.3959	123.1960	129.9480	133.4440	152.8804	167.5680	190.7830	(45)
Energy content (annual)										Total = Sum(45)m =		1866.4867	
Distribution loss (46)m = 0.15 x (45)m	29.0273	25.5675	26.8816	22.9417	21.7726	19.1094	18.4794	19.4922	20.0166	22.9321	25.1352	28.6174	(46)

Water storage loss:

Store volume 143.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)

Temperature factor from Table 2b 0.6000 (49)

Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(64)
									Total per year (kWh/year) = Sum(64)m =			2113.5187	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	81.1284	71.8350	76.3721	67.0973	65.0473	58.6023	57.7473	59.9924	60.6133	67.6174	71.9596	80.2200	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.8429	14.0716	11.4438	8.6637	6.4762	5.4675	5.9078	7.6792	10.3070	13.0871	15.2745	16.2833	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	204.2328	206.3521	201.0115	189.6421	175.2902	161.8015	152.7902	150.6709	156.0115	167.3809	181.7328	195.2215	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	(71)
Water heating gains (Table 5)													
	109.0436	106.8973	102.6507	93.1907	87.4292	81.3921	77.6173	80.6349	84.1852	90.8836	99.9438	107.8225	(72)
Total internal gains													
	406.5918	404.7935	392.5785	368.9690	346.6682	326.1336	313.7879	316.4575	327.9762	348.8241	374.4237	396.7998	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(79)

Solar gains	95.2051	173.0844	247.4999	322.5774	357.6553	345.0938	336.8383	300.1802	265.5901	190.1488	117.1921	83.3220	(83)
Total gains	501.7970	577.8779	640.0784	691.5463	704.3235	671.2274	650.6261	616.6377	593.5663	538.9729	491.6158	480.1218	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.0857	114.0857	115.1598	118.5070	119.0839	121.4487	122.6666	122.6666	120.2547	117.3699	116.2543	116.8094	
alpha	8.6057	8.6057	8.6773	8.9005	8.9389	9.0966	9.1778	9.1778	9.0170	8.8247	8.7503	8.7873	
util living area													
	0.7525	0.6499	0.5398	0.4138	0.3180	0.2478	0.1979	0.2123	0.2975	0.4623	0.6470	0.7737	(86)
MIT	20.9664	20.9888	20.9975	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9995	20.9914	20.9614	(87)
Th 2	20.5267	20.5267	20.5310	20.5437	20.5458	20.5543	20.5585	20.5585	20.5500	20.5394	20.5352	20.5373	(88)
util rest of house													
	0.7349	0.6325	0.5236	0.3995	0.3040	0.2336	0.1836	0.1971	0.2812	0.4435	0.6272	0.7568	(89)
MIT 2	20.4915	20.5153	20.5285	20.5435	20.5458	20.5543	20.5585	20.5585	20.5500	20.5390	20.5267	20.4965	(90)
Living area fraction										fLA = Living area / (4) =		0.5849	(91)
MIT	20.7693	20.7922	20.8029	20.8104	20.8114	20.8150	20.8167	20.8167	20.8132	20.8084	20.7985	20.7685	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7693	20.7922	20.8029	20.8104	20.8114	20.8150	20.8167	20.8167	20.8132	20.8084	20.7985	20.7685	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7440	0.6423	0.5330	0.4079	0.3122	0.2419	0.1920	0.2060	0.2907	0.4545	0.6384	0.7653	(94)
Useful gains	373.3455	371.1606	341.1768	282.0597	219.8798	162.3714	124.9081	127.0192	172.5578	244.9636	313.8665	367.4385	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	382.9119	374.3535	341.8681	282.1168	219.8843	162.3717	124.9081	127.0192	172.5596	245.0913	316.2767	378.3993	(97)
Space heating kWh													
	7.1174	2.1456	0.5143	0.0412	0.0034	0.0000	0.0000	0.0000	0.0000	0.0950	1.7354	8.1548	(98a)
Space heating requirement - total per year (kWh/year)												19.8071	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	7.1174	2.1456	0.5143	0.0412	0.0034	0.0000	0.0000	0.0000	0.0000	0.0950	1.7354	8.1548	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												19.8071	
Space heating per m2										(98c) / (4) =		0.4307	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	7.1174	2.1456	0.5143	0.0412	0.0034	0.0000	0.0000	0.0000	0.0000	0.0950	1.7354	8.1548	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	7.1174	2.1456	0.5143	0.0412	0.0034	0.0000	0.0000	0.0000	0.0000	0.0950	1.7354	8.1548	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.0057	7.2310	8.0057	7.7475	8.0057	7.7475	8.0057	8.0057	7.7475	8.0057	7.7475	8.0057	(231)

Lighting	13.8672	11.1248	10.0167	7.3386	5.6686	4.6313	5.1711	6.7215	8.7306	11.4550	12.9384	14.2526 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-9.8689	-16.7399	-28.5041	-37.7906	-44.3565	-41.9179	-41.6186	-36.5978	-29.5362	-20.6023	-11.7356	-8.4807 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-1.7861	-4.5704	-10.7679	-19.3163	-26.7566	-26.4829	-26.5288	-20.5306	-13.8236	-6.8408	-2.5812	-1.4176 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	19.8071 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2113.5187 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	94.2611 (230a)
Total electricity for the above, kWh/year	94.2611 (231)
Electricity for lighting (calculated in Appendix L)	111.9165 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-489.1519 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1850.3514 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	19.8071	25.1600	4.9835	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2113.5187	25.1600	531.7613	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	94.2611	25.1600	23.7161	(249)
Energy for lighting	111.9165	25.1600	28.1582	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-327.7490	25.1600	-82.4616	
PV Unit electricity exported	-161.4029	5.8100	-9.3775	
Total			-91.8392	(252)
Total energy cost			496.7799	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	19.8071	0.1612	3.1927	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2113.5187	0.1412	298.5203	(264)
Space and water heating			301.7130	(265)
Pumps, fans and electric keep-hot	94.2611	0.1387	13.0752	(267)
Energy for lighting	111.9165	0.1443	16.1530	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-327.7490	0.1319	-43.2158	
PV Unit electricity exported	-161.4029	0.1230	-19.8472	
Total			-63.0629	(269)
Total CO2, kg/year			267.8783	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	19.8071	1.5965	31.6214	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2113.5187	1.5223	3217.3749	(278)
Space and water heating			3248.9963	(279)
Pumps, fans and electric keep-hot	94.2611	1.5128	142.5982	(281)
Energy for lighting	111.9165	1.5338	171.6612	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-327.7490	1.4872	-487.4182	
PV Unit electricity exported	-161.4029	0.4513	-72.8385	
Total			-560.2566	(283)
Total Primary energy kWh/year			3002.9991	(286)

SAP 10 EPC IMPROVEMENTS

Unit 378 L05_Copy

Current energy efficiency rating: C 79
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 79
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£589	£589	£0
Space heating	£29	£29	£0
Water heating	£532	£532	£0
Lighting	£28	£28	£0
Generated (PV)	-£92	-£92	£0
Total cost of fuels	£497	£497	£0
Total cost of uses	£497	£497	£0
Delivered energy	40 kWh/m²	40 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	65 kWh/m²	65 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.9900 (1b)	x	2.4000 (2b)	=	110.3760	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.9900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	110.3760	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	16.0600	7.8800	8.1800	0.1400	1.1452	14.0000	114.5200	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.8828			(33)
Party Wall 1			23.2200	0.0000	0.0000	20.0000	464.4000	(32)
Wall to corridor			39.2800	0.0000	0.0000	20.0000	785.6000	(32)
Party Floor 1			45.9900			80.0000	3679.2000	(32d)
Party Ceiling 1			45.9900			80.0000	3679.2000	(32b)
Internal Wall 1			66.6300			9.0000	599.6700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9322.5900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.7091 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165
E18 Party wall between dwellings	2.7000	0.0600	0.1620
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.2120 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	12.0948 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	10.4981	10.3922	10.2864	9.7571	9.6512	9.1220	9.1220	9.0161	9.3337	9.6512	9.8630	10.0747	(38)
Heat transfer coeff	22.5929	22.4871	22.3812	21.8519	21.7461	21.2168	21.2168	21.1109	21.4285	21.7461	21.9578	22.1695	(39)
Average = Sum(39)m / 12 =												21.8255	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4913	0.4890	0.4867	0.4751	0.4728	0.4613	0.4613	0.4590	0.4659	0.4728	0.4774	0.4821	(40)
HLP (average)												0.4746	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.5731 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
69.5673	68.5219	66.9984	64.0836	61.9325	59.5337	58.1702	59.6821	61.3394	63.9151	66.8925	69.3008	(42a)

Hot water usage for baths

21.8805	21.5555	21.0979	20.2542	19.6224	18.9219	18.5435	18.9979	19.4926	20.2422	21.1034	21.8065	(42b)

Hot water usage for other uses

30.7397	29.6219	28.5041	27.3863	26.2684	25.1506	25.1506	26.2684	27.3863	28.5041	29.6219	30.7397	(42c)

Average daily hot water use (litres/day)		112.3706 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	122.1875	119.6993	116.6004	111.7240	107.8234	103.6062	101.8643	104.9484	108.2183	112.6614	117.6177	121.8470	(44)
Energy conte	193.5151	170.4502	179.2105	152.9446	145.1510	127.3959	123.1960	129.9480	133.4440	152.8804	167.5680	190.7830	(45)
Energy content (annual)										Total = Sum(45)m =		1866.4867	
Distribution loss (46)m = 0.15 x (45)m	29.0273	25.5675	26.8816	22.9417	21.7726	19.1094	18.4794	19.4922	20.0166	22.9321	25.1352	28.6174	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(64)

	Total per year (kWh/year) = Sum(64)m =	2113.5187 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000 (64a)

Heat gains from water heating, kWh/month

81.1284	71.8350	76.3721	67.0973	65.0473	58.6023	57.7473	59.9924	60.6133	67.6174	71.9596	80.2200	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.8429	14.0716	11.4438	8.6637	6.4762	5.4675	5.9078	7.6792	10.3070	13.0871	15.2745	16.2833	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	204.2328	206.3521	201.0115	189.6421	175.2902	161.8015	152.7902	150.6709	156.0115	167.3809	181.7328	195.2215	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	(71)
Water heating gains (Table 5)	109.0436	106.8973	102.6507	93.1907	87.4292	81.3921	77.6173	80.6349	84.1852	90.8836	99.9438	107.8225	(72)
Total internal gains	406.5918	404.7935	392.5785	368.9690	346.6682	326.1336	313.7879	316.4575	327.9762	348.8241	374.4237	396.7998	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	104.6841	178.3157	243.9793	302.3022	338.6036	336.1550	324.0893	297.0068	264.1780	197.0768	125.3874	89.5877	(83)
Total gains	511.2759	583.1092	636.5578	671.2711	685.2718	662.2886	637.8772	613.4643	592.1541	545.9009	499.8110	486.3875	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.6202	115.1598	115.7045	118.5070	119.0839	122.0546	122.0546	122.6666	120.8487	119.0839	117.9357	116.8094	
alpha	8.6413	8.6773	8.7136	8.9005	8.9389	9.1370	9.1370	9.1778	9.0566	8.9389	8.8624	8.7873	
util living area	0.7232	0.6171	0.5091	0.3938	0.2951	0.2050	0.1464	0.1583	0.2497	0.4142	0.6076	0.7472	(86)
MIT	20.9759	20.9929	20.9986	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9998	20.9952	20.9711	(87)
Th 2	20.5289	20.5310	20.5331	20.5437	20.5458	20.5564	20.5564	20.5585	20.5522	20.5458	20.5415	20.5373	(88)
util rest of house	0.7052	0.5998	0.4929	0.3790	0.2807	0.1908	0.1316	0.1431	0.2335	0.3961	0.5882	0.7296	(89)
MIT 2	20.5038	20.5238	20.5317	20.5436	20.5458	20.5564	20.5564	20.5585	20.5522	20.5457	20.5369	20.5072	(90)
Living area fraction										fLA = Living area / (4) =		0.5849	(91)
MIT	20.7799	20.7982	20.8048	20.8105	20.8115	20.8159	20.8159	20.8167	20.8141	20.8113	20.8049	20.7786	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7799	20.7982	20.8048	20.8105	20.8115	20.8159	20.8159	20.8167	20.8141	20.8113	20.8049	20.7786	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7148	0.6097	0.5023	0.3877	0.2891	0.1991	0.1402	0.1520	0.2430	0.4067	0.5994	0.7388	(94)
Useful gains	365.4773	355.5043	319.7589	260.2320	198.1363	131.8807	89.4472	93.2417	143.8729	222.0136	299.5858	359.3539	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	372.3303	357.5044	320.1584	260.2666	198.1384	131.8808	89.4472	93.2417	143.8732	222.0560	300.9299	367.5386	(97)
Space heating kWh	5.0986	1.3441	0.2972	0.0250	0.0016	0.0000	0.0000	0.0000	0.0000	0.0316	0.9678	6.0895	(98a)
Space heating requirement - total per year (kWh/year)												13.8553	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	5.0986	1.3441	0.2972	0.0250	0.0016	0.0000	0.0000	0.0000	0.0000	0.0316	0.9678	6.0895	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												13.8553	
Space heating per m2											(98c) / (4) =	0.3013	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	5.0986	1.3441	0.2972	0.0250	0.0016	0.0000	0.0000	0.0000	0.0000	0.0316	0.9678	6.0895	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	5.0986	1.3441	0.2972	0.0250	0.0016	0.0000	0.0000	0.0000	0.0000	0.0316	0.9678	6.0895	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.0057	7.2310	8.0057	7.7475	8.0057	7.7475	8.0057	8.0057	7.7475	8.0057	7.7475	8.0057	(231)
Lighting	13.8672	11.1248	10.0167	7.3386	5.6686	4.6313	5.1711	6.7215	8.7306	11.4550	12.9384	14.2526	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.9014	-17.4086	-28.5096	-36.2296	-42.8123	-41.3020	-40.6525	-36.5864	-29.7361	-21.5179	-12.6331	-9.1811	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.1026	-4.8842	-10.7759	-17.9155	-25.0683	-25.7639	-25.3939	-20.5190	-13.9892	-7.3639	-2.9146	-1.6147	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												13.8553	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2113.5187	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	94.2611	(230a)
Total electricity for the above, kWh/year	94.2611	(231)
Electricity for lighting (calculated in Appendix L)	111.9165	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-485.7761	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1847.7754	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	13.8553	16.4900	2.2847	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2113.5187	16.4900	348.5192	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	94.2611	16.4900	15.5437	(249)
Energy for lighting	111.9165	16.4900	18.4550	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-327.4705	16.4900	-53.9999	
PV Unit electricity exported	-158.3056	5.5900	-8.8493	
Total			-62.8492	(252)
Total energy cost			321.9535	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2738	(257)
SAP value		79.3517	
SAP rating (Section 12)		79	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	13.8553	0.1616	2.2384	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2113.5187	0.1412	298.5203	(264)
Space and water heating			300.7587	(265)
Pumps, fans and electric keep-hot	94.2611	0.1387	13.0752	(267)
Energy for lighting	111.9165	0.1443	16.1530	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-327.4705	0.1322	-43.2810	
PV Unit electricity exported	-158.3056	0.1234	-19.5419	
Total			-62.8230	(269)
Total CO2, kg/year			267.1640	(272)
CO2 emissions per m2			5.8100	(273)
EI value			96.0655	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		45.9900	(1b)	x 2.4000	(2b) =	110.3760	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.9900						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		110.3760	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	16.0600	7.8800	8.1800	0.1400	1.1452	14.0000	114.5200	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.8828			(33)
Party Wall 1			23.2200	0.0000	0.0000	20.0000	464.4000	(32)
Wall to corridor			39.2800	0.0000	0.0000	20.0000	785.6000	(32)
Party Floor 1			45.9900			80.0000	3679.2000	(32d)
Party Ceiling 1			45.9900			80.0000	3679.2000	(32b)
Internal Wall 1			66.6300			9.0000	599.6700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 9322.5900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	202.7091 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165
E18 Party wall between dwellings	2.7000	0.0600	0.1620
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	1.2120 (36)
Point Thermal bridges	(36a) = 0.0000
Total fabric heat loss	(33) + (36) + (36a) = 12.0948 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	10.6040	10.6040	10.3922	9.7571	9.6512	9.2278	9.0161	9.0161	9.4395	9.9688	10.1805	10.0747	(38)
Heat transfer coeff	22.6988	22.6988	22.4871	21.8519	21.7461	21.3227	21.1109	21.1109	21.5344	22.0637	22.2754	22.1695	(39)
Average = Sum(39)m / 12 =												21.9225	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4936	0.4936	0.4890	0.4751	0.4728	0.4636	0.4590	0.4590	0.4682	0.4797	0.4844	0.4821	(40)
HLP (average)												0.4767	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.5731 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	69.5673	68.5219	66.9984	64.0836	61.9325	59.5337	58.1702	59.6821	61.3394	63.9151	66.8925	69.3008	(42a)
Hot water usage for baths	21.8805	21.5555	21.0979	20.2542	19.6224	18.9219	18.5435	18.9979	19.4926	20.2422	21.1034	21.8065	(42b)
Hot water usage for other uses	30.7397	29.6219	28.5041	27.3863	26.2684	25.1506	25.1506	26.2684	27.3863	28.5041	29.6219	30.7397	(42c)
Average daily hot water use (litres/day)												112.3706	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	122.1875	119.6993	116.6004	111.7240	107.8234	103.6062	101.8643	104.9484	108.2183	112.6614	117.6177	121.8470	(44)
Energy conte	193.5151	170.4502	179.2105	152.9446	145.1510	127.3959	123.1960	129.9480	133.4440	152.8804	167.5680	190.7830	(45)
Energy content (annual)										Total = Sum(45)m =		1866.4867	
Distribution loss (46)m = 0.15 x (45)m	29.0273	25.5675	26.8816	22.9417	21.7726	19.1094	18.4794	19.4922	20.0166	22.9321	25.1352	28.6174	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(64)
									Total per year (kWh/year) = Sum(64)m =			2113.5187	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	81.1284	71.8350	76.3721	67.0973	65.0473	58.6023	57.7473	59.9924	60.6133	67.6174	71.9596	80.2200	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.8429	14.0716	11.4438	8.6637	6.4762	5.4675	5.9078	7.6792	10.3070	13.0871	15.2745	16.2833	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	204.2328	206.3521	201.0115	189.6421	175.2902	161.8015	152.7902	150.6709	156.0115	167.3809	181.7328	195.2215	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	(71)
Water heating gains (Table 5)	109.0436	106.8973	102.6507	93.1907	87.4292	81.3921	77.6173	80.6349	84.1852	90.8836	99.9438	107.8225	(72)
Total internal gains	406.5918	404.7935	392.5785	368.9690	346.6682	326.1336	313.7879	316.4575	327.9762	348.8241	374.4237	396.7998	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(79)

Solar gains	95.2051	173.0844	247.4999	322.5774	357.6553	345.0938	336.8383	300.1802	265.5901	190.1488	117.1921	83.3220	(83)
Total gains	501.7970	577.8779	640.0784	691.5463	704.3235	671.2274	650.6261	616.6377	593.5663	538.9729	491.6158	480.1218	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.0857	114.0857	115.1598	118.5070	119.0839	121.4487	122.6666	122.6666	120.2547	117.3699	116.2543	116.8094	
alpha	8.6057	8.6057	8.6773	8.9005	8.9389	9.0966	9.1778	9.1778	9.0170	8.8247	8.7503	8.7873	
util living area	0.7525	0.6499	0.5398	0.4138	0.3180	0.2478	0.1979	0.2123	0.2975	0.4623	0.6470	0.7737	(86)
MIT	20.9664	20.9888	20.9975	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9995	20.9914	20.9614	(87)
Th 2	20.5267	20.5267	20.5310	20.5437	20.5458	20.5543	20.5585	20.5585	20.5500	20.5394	20.5352	20.5373	(88)
util rest of house	0.7349	0.6325	0.5236	0.3995	0.3040	0.2336	0.1836	0.1971	0.2812	0.4435	0.6272	0.7568	(89)
MIT 2	20.4915	20.5153	20.5285	20.5435	20.5458	20.5543	20.5585	20.5585	20.5500	20.5390	20.5267	20.4965	(90)
Living area fraction										fLA = Living area / (4) =		0.5849	(91)
MIT	20.7693	20.7922	20.8029	20.8104	20.8114	20.8150	20.8167	20.8167	20.8132	20.8084	20.7985	20.7685	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7693	20.7922	20.8029	20.8104	20.8114	20.8150	20.8167	20.8167	20.8132	20.8084	20.7985	20.7685	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7440	0.6423	0.5330	0.4079	0.3122	0.2419	0.1920	0.2060	0.2907	0.4545	0.6384	0.7653	(94)
Useful gains	373.3455	371.1606	341.1768	282.0597	219.8798	162.3714	124.9081	127.0192	172.5578	244.9636	313.8665	367.4385	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	382.9119	374.3535	341.8681	282.1168	219.8843	162.3717	124.9081	127.0192	172.5596	245.0913	316.2767	378.3993	(97)
Space heating kWh	7.1174	2.1456	0.5143	0.0412	0.0034	0.0000	0.0000	0.0000	0.0000	0.0950	1.7354	8.1548	(98a)
Space heating requirement - total per year (kWh/year)												19.8071	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	7.1174	2.1456	0.5143	0.0412	0.0034	0.0000	0.0000	0.0000	0.0000	0.0950	1.7354	8.1548	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												19.8071	
Space heating per m2											(98c) / (4) =	0.4307	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	7.1174	2.1456	0.5143	0.0412	0.0034	0.0000	0.0000	0.0000	0.0000	0.0950	1.7354	8.1548	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													

	7.1174	2.1456	0.5143	0.0412	0.0034	0.0000	0.0000	0.0000	0.0000	0.0950	1.7354	8.1548 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	8.0057	7.2310	8.0057	7.7475	8.0057	7.7475	8.0057	8.0057	7.7475	8.0057	7.7475	8.0057 (231)
Lighting	13.8672	11.1248	10.0167	7.3386	5.6686	4.6313	5.1711	6.7215	8.7306	11.4550	12.9384	14.2526 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-9.8689	-16.7399	-28.5041	-37.7906	-44.3565	-41.9179	-41.6186	-36.5978	-29.5362	-20.6023	-11.7356	-8.4807 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-1.7861	-4.5704	-10.7679	-19.3163	-26.7566	-26.4829	-26.5288	-20.5306	-13.8236	-6.8408	-2.5812	-1.4176 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	19.8071 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2113.5187 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	94.2611 (230a)
Total electricity for the above, kWh/year	94.2611 (231)
Electricity for lighting (calculated in Appendix L)	111.9165 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-489.1519 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1850.3514 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	19.8071	25.1600	4.9835	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2113.5187	25.1600	531.7613	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	94.2611	25.1600	23.7161	(249)
Energy for lighting	111.9165	25.1600	28.1582	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-327.7490	25.1600	-82.4616	
PV Unit electricity exported	-161.4029	5.8100	-9.3775	
Total			-91.8392	(252)
Total energy cost			496.7799	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	19.8071	0.1612	3.1927	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2113.5187	0.1412	298.5203	(264)
Space and water heating			301.7130	(265)
Pumps, fans and electric keep-hot	94.2611	0.1387	13.0752	(267)
Energy for lighting	111.9165	0.1443	16.1530	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-327.7490	0.1319	-43.2158	
PV Unit electricity exported	-161.4029	0.1230	-19.8472	
Total			-63.0629	(269)
Total CO2, kg/year			267.8783	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	19.8071	1.5965	31.6214	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2113.5187	1.5223	3217.3749	(278)
Space and water heating			3248.9963	(279)

Pumps, fans and electric keep-hot	94.2611	1.5128	142.5982 (281)
Energy for lighting	111.9165	1.5338	171.6612 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-327.7490	1.4872	-487.4182
PV Unit electricity exported	-161.4029	0.4513	-72.8385
Total			-560.2566 (283)
Total Primary energy kWh/year			3002.9991 (286)

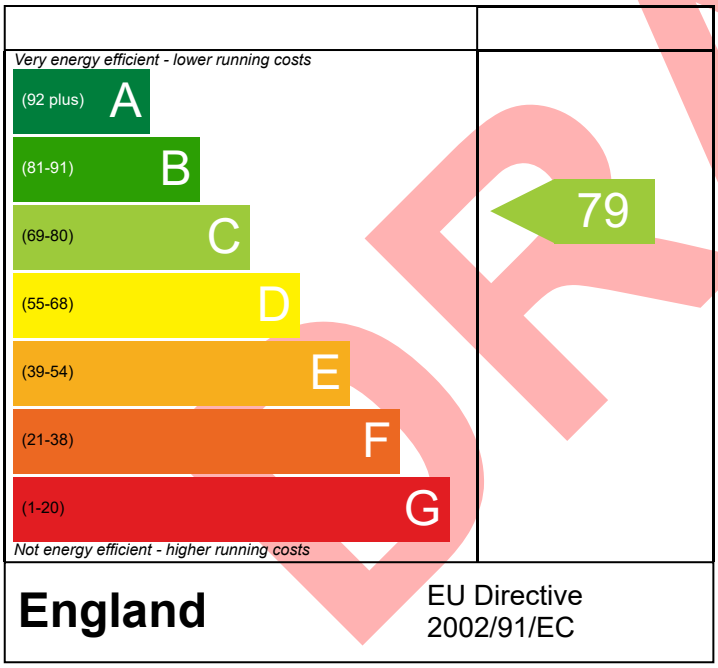
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	45.99 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

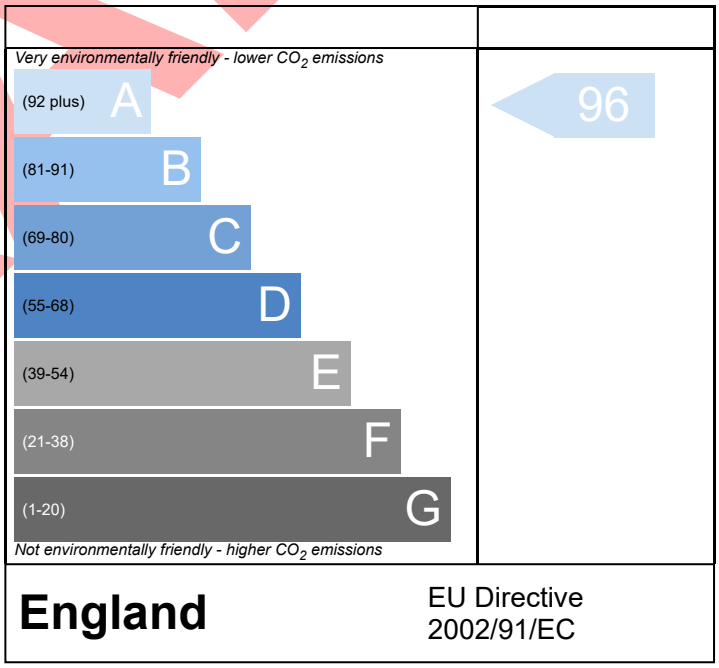
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:08

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	51 m^2
Site Reference	Unit 379 L05_Copy	Plot Reference	Unit 379 L05_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.15 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	5.41 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*60.59 kWh$_{PE}$/m^2*	
Dwelling primary energy	60.93 kWh$_{PE}$/m^2	FAIL
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*12.8 kWh/m^2*	
Dwelling fabric energy efficiency	11.8 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	8.18	0.14 **(!)**
Party wall: Party Wall (1)	46.44	0 **(!)**
Party wall: Party Wall (2)	16.06	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	7.88	South West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.66 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 379 L05_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 379 L05_Copy	**Prop Type Ref**	Unit 379 L05
Property			

SAP Rating	80 C	**DER**	5.41	**TER**	11.15
Environmental	96 A	**% DER < TER**			51.48
CO_2 Emissions (t/year)	0.28	**DFEE**	11.85	**TFEE**	12.80
Compliance Check	See BREL	**% DFEE < TFEE**			7.47
% DPER < TPER	-0.56	**DPER**	60.93	**TPER**	60.59

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.1700	(1b)	x 2.4000	(2b) =	122.8080	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.1700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		122.8080	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	16.0600	7.8800	8.1800	0.1400	1.1452	14.0000	114.5200	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.8828			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			16.0600	0.0000	0.0000	20.0000	321.2000	(32)
Party Floor 1			51.1700			80.0000	4093.6000	(32d)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			79.3800			9.0000	714.4200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10266.1400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		200.6281 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695

E4 Jamb	9.2800	0.0500	0.4640	
E7 Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.3740 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 12.2568 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.6805	11.5628	11.4450	10.8561	10.7383	10.1494	10.1494	10.0316	10.3850	10.7383	10.9739	11.2094	(38)
Heat transfer coeff	23.9374	23.8196	23.7018	23.1129	22.9951	22.4062	22.4062	22.2885	22.6418	22.9951	23.2307	23.4663	(39)
Average = Sum(39)m / 12 =												23.0835	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4678	0.4655	0.4632	0.4517	0.4494	0.4379	0.4379	0.4356	0.4425	0.4494	0.4540	0.4586	(40)
HLP (average)												0.4511	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7246 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.0608	71.9628	70.3629	67.3017	65.0426	62.5233	61.0913	62.6791	64.4197	67.1247	70.2516	72.7809	(42a)
Hot water usage for baths	22.9731	22.6319	22.1514	21.2656	20.6022	19.8667	19.4694	19.9465	20.4660	21.2530	22.1571	22.8954	(42b)
Hot water usage for other uses	32.2915	31.1172	29.9430	28.7688	27.5945	26.4203	26.4203	27.5945	28.7688	29.9430	31.1172	32.2915	(42c)
Average daily hot water use (litres/day)												118.0151	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.3253	125.7119	122.4573	117.3360	113.2393	108.8102	106.9810	110.2201	113.6544	118.3207	123.5260	127.9677	(44)
Energy conte	203.2359	179.0121	188.2123	160.6271	152.4419	133.7949	129.3842	136.4755	140.1472	160.5600	175.9854	200.3665	(45)
Energy content (annual)										Total = Sum(45)m =		1960.2433	
Distribution loss (46)m = 0.15 x (45)m	30.4854	26.8518	28.2318	24.0941	22.8663	20.0692	19.4076	20.4713	21.0221	24.0840	26.3978	30.0550	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
										Total per year (kWh/year) = Sum(64)m =		2207.2753	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	84.3606	74.6819	79.3652	69.6517	67.4716	60.7300	59.8049	62.1628	62.8422	70.1708	74.7583	83.4065	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.6375	15.6655	12.7400	9.6450	7.2098	6.0868	6.5770	8.5490	11.4745	14.5695	17.0047	18.1277	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	224.2868	226.6142	220.7492	208.2634	192.5023	177.6891	167.7930	165.4656	171.3306	183.8164	199.5774	214.3906	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	(71)
Water heating gains (Table 5)	113.3879	111.1337	106.6737	96.7385	90.6876	84.3472	80.3829	83.5521	87.2808	94.3157	103.8310	112.1055	(72)
Total internal gains	436.8760	434.9772	421.7267	396.2107	371.9635	349.6869	336.3167	339.1305	351.6496	374.2653	401.9770	426.1877	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	104.6841	178.3157	243.9793	302.3022	338.6036	336.1550	324.0893	297.0068	264.1780	197.0768	125.3874	89.5877	(83)
Total gains	541.5600	613.2928	665.7060	698.5129	710.5671	685.8419	660.4060	636.1373	615.8276	571.3421	527.3644	515.7754	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	119.1319	119.7210	120.3159	123.3815	124.0134	127.2729	127.2729	127.9454	125.9487	124.0134	122.7559	121.5237	
alpha	8.9421	8.9814	9.0211	9.2254	9.2676	9.4849	9.4849	9.5297	9.3966	9.2676	9.1837	9.1016	
util living area													
	0.7247	0.6218	0.5156	0.4003	0.3010	0.2091	0.1493	0.1612	0.2537	0.4185	0.6097	0.7476	(86)
MIT	20.9788	20.9938	20.9988	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9999	20.9959	20.9748	(87)
Th 2	20.5504	20.5526	20.5547	20.5653	20.5674	20.5781	20.5781	20.5802	20.5738	20.5674	20.5632	20.5589	(88)
util rest of house													
	0.7074	0.6052	0.4999	0.3860	0.2870	0.1953	0.1350	0.1465	0.2380	0.4011	0.5911	0.7306	(89)
MIT 2	20.5284	20.5463	20.5535	20.5652	20.5674	20.5781	20.5781	20.5802	20.5738	20.5673	20.5592	20.5326	(90)
Living area fraction										fLA = Living area / (4) =		0.5576	(91)
MIT	20.7795	20.7958	20.8017	20.8076	20.8086	20.8133	20.8133	20.8143	20.8114	20.8085	20.8027	20.7792	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7795	20.7958	20.8017	20.8076	20.8086	20.8133	20.8133	20.8143	20.8114	20.8085	20.8027	20.7792	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7163	0.6142	0.5086	0.3940	0.2948	0.2030	0.1429	0.1547	0.2468	0.4108	0.6013	0.7392	(94)
Useful gains	387.8953	376.7106	338.5994	275.1878	209.4519	139.2173	94.4049	98.3874	151.9589	234.7094	317.0931	381.2564	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	394.4762	378.6309	338.9773	275.2187	209.4537	139.2174	94.4049	98.3874	151.9591	234.7458	318.3236	389.0512	(97)
Space heating kWh													
	4.8961	1.2904	0.2812	0.0223	0.0013	0.0000	0.0000	0.0000	0.0000	0.0271	0.8860	5.7993	(98a)
Space heating requirement - total per year (kWh/year)												13.2037	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	4.8961	1.2904	0.2812	0.0223	0.0013	0.0000	0.0000	0.0000	0.0000	0.0271	0.8860	5.7993	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												13.2037	
Space heating per m2											(98c) / (4) =	0.2580	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	4.8961	1.2904	0.2812	0.0223	0.0013	0.0000	0.0000	0.0000	0.0000	0.0271	0.8860	5.7993	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	4.8961	1.2904	0.2812	0.0223	0.0013	0.0000	0.0000	0.0000	0.0000	0.0271	0.8860	5.7993	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9074	8.0454	8.9074	8.6201	8.9074	8.6201	8.9074	8.9074	8.6201	8.9074	8.6201	8.9074	(231)
Lighting	15.4380	12.3850	11.1513	8.1699	6.3107	5.1559	5.7568	7.4829	9.7196	12.7526	14.4040	15.8671	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.1420	-19.3585	-31.6479	-40.1405	-47.3610	-45.6598	-44.9395	-40.4814	-32.9522	-23.8996	-14.0606	-10.2289	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4049	-5.5792	-12.2985	-20.4286	-28.5733	-29.3630	-28.9430	-23.3991	-15.9608	-8.4088	-3.3317	-1.8477	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	13.2037	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2207.2753	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	104.8780	(230a)
Total electricity for the above, kWh/year	104.8780	(231)
Electricity for lighting (calculated in Appendix L)	124.5936	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-543.4106	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1906.5401	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	13.2037	16.4900	2.1773	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	16.4900	363.9797	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	104.8780	16.4900	17.2944	(249)
Energy for lighting	124.5936	16.4900	20.5455	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-362.8720	16.4900	-59.8376	
PV Unit electricity exported	-180.5386	5.5900	-10.0921	
Total			-69.9297	(252)
Total energy cost			334.0672	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2505	(257)
SAP value		79.7288	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	13.2037	0.1616	2.1337	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2207.2753	0.1413	311.7942	(264)
Space and water heating			313.9279	(265)
Pumps, fans and electric keep-hot	104.8780	0.1387	14.5479	(267)
Energy for lighting	124.5936	0.1443	17.9827	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-362.8720	0.1322	-47.9727	
PV Unit electricity exported	-180.5386	0.1235	-22.2897	
Total			-70.2624	(269)
Total CO2, kg/year			276.1961	(272)
CO2 emissions per m2			5.4000	(273)
EI value			96.1516	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		51.1700 (1b)	x	2.4000 (2b)	=	122.8080	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.1700						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	122.8080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	16.0600	7.8800	8.1800	0.1400	1.1452	14.0000	114.5200	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.8828			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			16.0600	0.0000	0.0000	20.0000	321.2000	(32)
Party Floor 1			51.1700			80.0000	4093.6000	(32d)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			79.3800			9.0000	714.4200	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 10266.1400 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 200.6281 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4	Jamb	9.2800	0.0500	0.4640
E7	Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165
E18	Party wall between dwellings	5.4000	0.0600	0.3240
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.3740 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 12.2568 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.7983	11.7983	11.5628	10.8561	10.7383	10.2672	10.0316	10.0316	10.5027	11.0916	11.3272	11.2094	(38)
Heat transfer coeff	24.0552	24.0552	23.8196	23.1129	22.9951	22.5240	22.2885	22.2885	22.7596	23.3485	23.5840	23.4663	(39)

Average = Sum(39)m / 12 = 23.1914

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4701	0.4701	0.4655	0.4517	0.4494	0.4402	0.4356	0.4356	0.4448	0.4563	0.4609	0.4586	(40)
HLP (average)												0.4532	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7246 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.0608	71.9628	70.3629	67.3017	65.0426	62.5233	61.0913	62.6791	64.4197	67.1247	70.2516	72.7809	(42a)
Hot water usage for baths	22.9731	22.6319	22.1514	21.2656	20.6022	19.8667	19.4694	19.9465	20.4660	21.2530	22.1571	22.8954	(42b)
Hot water usage for other uses	32.2915	31.1172	29.9430	28.7688	27.5945	26.4203	26.4203	27.5945	28.7688	29.9430	31.1172	32.2915	(42c)

Average daily hot water use (litres/day) 118.0151 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.3253	125.7119	122.4573	117.3360	113.2393	108.8102	106.9810	110.2201	113.6544	118.3207	123.5260	127.9677	(44)
Energy conte	203.2359	179.0121	188.2123	160.6271	152.4419	133.7949	129.3842	136.4755	140.1472	160.5600	175.9854	200.3665	(45)
Energy content (annual)										Total = Sum(45)m =		1960.2433	
Distribution loss (46)m = 0.15 x (45)m	30.4854	26.8518	28.2318	24.0941	22.8663	20.0692	19.4076	20.4713	21.0221	24.0840	26.3978	30.0550	(46)

Water storage loss:

Store volume 143.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)

Temperature factor from Table 2b 0.6000 (49)

Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
										Total per year (kWh/year) = Sum(64)m =		2207.2753	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	84.3606	74.6819	79.3652	69.6517	67.4716	60.7300	59.8049	62.1628	62.8422	70.1708	74.7583	83.4065	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	17.6375	15.6655	12.7400	9.6450	7.2098	6.0868	6.5770	8.5490	11.4745	14.5695	17.0047	18.1277	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	224.2868	226.6142	220.7492	208.2634	192.5023	177.6891	167.7930	165.4656	171.3306	183.8164	199.5774	214.3906	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	(71)
Water heating gains (Table 5)													
	113.3879	111.1337	106.6737	96.7385	90.6876	84.3472	80.3829	83.5521	87.2808	94.3157	103.8310	112.1055	(72)
Total internal gains													
	436.8760	434.9772	421.7267	396.2107	371.9635	349.6869	336.3167	339.1305	351.6496	374.2653	401.9770	426.1877	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(79)

Solar gains	95.2051	173.0844	247.4999	322.5774	357.6553	345.0938	336.8383	300.1802	265.5901	190.1488	117.1921	83.3220	(83)
Total gains	532.0811	608.0616	669.2266	718.7881	729.6188	694.7807	673.1549	639.3107	617.2397	564.4141	519.1691	509.5097	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	118.5486	118.5486	119.7210	123.3815	124.0134	126.6073	127.9454	127.9454	125.2970	122.1367	120.9168	121.5237	
alpha	8.9032	8.9032	8.9814	9.2254	9.2676	9.4405	9.5297	9.5297	9.3531	9.1424	9.0611	9.1016	
util living area													
	0.7538	0.6550	0.5470	0.4212	0.3246	0.2529	0.2020	0.2162	0.3024	0.4672	0.6492	0.7740	(86)
MIT	20.9702	20.9899	20.9978	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9996	20.9926	20.9661	(87)
Th 2	20.5483	20.5483	20.5526	20.5653	20.5674	20.5760	20.5802	20.5802	20.5717	20.5611	20.5568	20.5589	(88)
util rest of house													
	0.7369	0.6382	0.5313	0.4072	0.3110	0.2391	0.1881	0.2015	0.2866	0.4491	0.6302	0.7576	(89)
MIT 2	20.5170	20.5380	20.5504	20.5651	20.5674	20.5760	20.5802	20.5802	20.5717	20.5607	20.5495	20.5230	(90)
Living area fraction										fLA = Living area / (4) =		0.5576	(91)
MIT	20.7697	20.7900	20.7999	20.8075	20.8086	20.8124	20.8143	20.8143	20.8105	20.8054	20.7965	20.7701	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7697	20.7900	20.7999	20.8075	20.8086	20.8124	20.8143	20.8143	20.8105	20.8054	20.7965	20.7701	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7453	0.6472	0.5400	0.4150	0.3186	0.2468	0.1958	0.2097	0.2954	0.4592	0.6405	0.7655	(94)
Useful gains	396.5380	393.5486	361.3857	298.2777	232.4448	171.4613	131.8200	134.0489	182.3141	259.1802	332.5508	390.0548	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	405.8027	396.6690	362.0545	298.3300	232.4487	171.4615	131.8201	134.0489	182.3155	259.2946	334.8115	400.5712	(97)
Space heating kWh													
	6.8930	2.0969	0.4976	0.0377	0.0029	0.0000	0.0000	0.0000	0.0000	0.0851	1.6276	7.8241	(98a)
Space heating requirement - total per year (kWh/year)												19.0650	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	6.8930	2.0969	0.4976	0.0377	0.0029	0.0000	0.0000	0.0000	0.0000	0.0851	1.6276	7.8241	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												19.0650	
Space heating per m2										(98c) / (4) =		0.3726	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	6.8930	2.0969	0.4976	0.0377	0.0029	0.0000	0.0000	0.0000	0.0000	0.0851	1.6276	7.8241	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	6.8930	2.0969	0.4976	0.0377	0.0029	0.0000	0.0000	0.0000	0.0000	0.0851	1.6276	7.8241	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9074	8.0454	8.9074	8.6201	8.9074	8.6201	8.9074	8.9074	8.6201	8.9074	8.6201	8.9074	(231)

Lighting	15.4380	12.3850	11.1513	8.1699	6.3107	5.1559	5.7568	7.4829	9.7196	12.7526	14.4040	15.8671	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.9944	-18.6173	-31.6417	-41.8588	-49.0561	-46.3351	-45.9986	-40.4939	-32.7321	-22.8868	-13.0643	-9.4500	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.0435	-5.2214	-12.2897	-22.0235	-30.4942	-30.1810	-30.2340	-23.4124	-15.7721	-7.8122	-2.9511	-1.6227	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	19.0650	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2207.2753	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	104.8780	(230a)
Total electricity for the above, kWh/year	104.8780	(231)
Electricity for lighting (calculated in Appendix L)	124.5936	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-547.1869	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1908.6251	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	19.0650	25.1600	4.7968	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	25.1600	555.3505	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	104.8780	25.1600	26.3873	(249)
Energy for lighting	124.5936	25.1600	31.3478	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1291	25.1600	-91.3633	
PV Unit electricity exported	-184.0578	5.8100	-10.6938	
Total			-102.0570	(252)
Total energy cost			515.8253	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	19.0650	0.1612	3.0737	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2207.2753	0.1413	311.7942	(264)
Space and water heating			314.8679	(265)
Pumps, fans and electric keep-hot	104.8780	0.1387	14.5479	(267)
Energy for lighting	124.5936	0.1443	17.9827	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1291	0.1319	-47.8936	
PV Unit electricity exported	-184.0578	0.1230	-22.6361	
Total			-70.5297	(269)
Total CO2, kg/year			276.8688	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	19.0650	1.5966	30.4390	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	1.5223	3360.2168	(278)
Space and water heating			3390.6558	(279)
Pumps, fans and electric keep-hot	104.8780	1.5128	158.6595	(281)
Energy for lighting	124.5936	1.5338	191.1059	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1291	1.4873	-540.0823	
PV Unit electricity exported	-184.0578	0.4513	-83.0740	
Total			-623.1563	(283)
Total Primary energy kWh/year			3117.2649	(286)

SAP 10 EPC IMPROVEMENTS

Unit 379 L05_Copy

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 80
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£618	£618	£0
Space heating	£31	£31	£0
Water heating	£555	£555	£0
Lighting	£31	£31	£0
Generated (PV)	-£102	-£102	£0
Total cost of fuels	£516	£516	£0
Total cost of uses	£515	£515	£0
Delivered energy	37 kWh/m²	37 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	61 kWh/m²	61 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.1700 (1b)	x	2.4000 (2b)	=	122.8080	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.1700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	122.8080	(5)

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2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	16.0600	7.8800	8.1800	0.1400	1.1452	14.0000	114.5200	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.8828			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			16.0600	0.0000	0.0000	20.0000	321.2000	(32)
Party Floor 1			51.1700			80.0000	4093.6000	(32d)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			79.3800			9.0000	714.4200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10266.1400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		200.6281 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.3740 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	12.2568 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.6805	11.5628	11.4450	10.8561	10.7383	10.1494	10.1494	10.0316	10.3850	10.7383	10.9739	11.2094	(38)
Heat transfer coeff	23.9374	23.8196	23.7018	23.1129	22.9951	22.4062	22.4062	22.2885	22.6418	22.9951	23.2307	23.4663	(39)
Average = Sum(39)m / 12 =												23.0835	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4678	0.4655	0.4632	0.4517	0.4494	0.4379	0.4379	0.4356	0.4425	0.4494	0.4540	0.4586	(40)
HLP (average)												0.4511	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.7246 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.0608	71.9628	70.3629	67.3017	65.0426	62.5233	61.0913	62.6791	64.4197	67.1247	70.2516	72.7809	(42a)

Hot water usage for baths

22.9731	22.6319	22.1514	21.2656	20.6022	19.8667	19.4694	19.9465	20.4660	21.2530	22.1571	22.8954	(42b)

Hot water usage for other uses

32.2915	31.1172	29.9430	28.7688	27.5945	26.4203	26.4203	27.5945	28.7688	29.9430	31.1172	32.2915	(42c)

Average daily hot water use (litres/day)		118.0151 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.3253	125.7119	122.4573	117.3360	113.2393	108.8102	106.9810	110.2201	113.6544	118.3207	123.5260	127.9677	(44)
Energy conte	203.2359	179.0121	188.2123	160.6271	152.4419	133.7949	129.3842	136.4755	140.1472	160.5600	175.9854	200.3665	(45)
Energy content (annual)										Total = Sum(45)m =		1960.2433	

Distribution loss (46)m = 0.15 x (45)m

30.4854	26.8518	28.2318	24.0941	22.8663	20.0692	19.4076	20.4713	21.0221	24.0840	26.3978	30.0550	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)

	Total per year (kWh/year) = Sum(64)m =	2207.2753 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000 (64a)

Heat gains from water heating, kWh/month

84.3606	74.6819	79.3652	69.6517	67.4716	60.7300	59.8049	62.1628	62.8422	70.1708	74.7583	83.4065	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.6375	15.6655	12.7400	9.6450	7.2098	6.0868	6.5770	8.5490	11.4745	14.5695	17.0047	18.1277	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	224.2868	226.6142	220.7492	208.2634	192.5023	177.6891	167.7930	165.4656	171.3306	183.8164	199.5774	214.3906	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	(71)
Water heating gains (Table 5)	113.3879	111.1337	106.6737	96.7385	90.6876	84.3472	80.3829	83.5521	87.2808	94.3157	103.8310	112.1055	(72)
Total internal gains	436.8760	434.9772	421.7267	396.2107	371.9635	349.6869	336.3167	339.1305	351.6496	374.2653	401.9770	426.1877	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(79)

Solar gains	104.6841	178.3157	243.9793	302.3022	338.6036	336.1550	324.0893	297.0068	264.1780	197.0768	125.3874	89.5877 (83)
Total gains	541.5600	613.2928	665.7060	698.5129	710.5671	685.8419	660.4060	636.1373	615.8276	571.3421	527.3644	515.7754 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	119.1319	119.7210	120.3159	123.3815	124.0134	127.2729	127.2729	127.9454	125.9487	124.0134	122.7559	121.5237	
alpha	8.9421	8.9814	9.0211	9.2254	9.2676	9.4849	9.4849	9.5297	9.3966	9.2676	9.1837	9.1016	
util living area	0.7247	0.6218	0.5156	0.4003	0.3010	0.2091	0.1493	0.1612	0.2537	0.4185	0.6097	0.7476	(86)
MIT	20.9788	20.9938	20.9988	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9999	20.9959	20.9748	(87)
Th 2	20.5504	20.5526	20.5547	20.5653	20.5674	20.5781	20.5781	20.5802	20.5738	20.5674	20.5632	20.5589	(88)
util rest of house	0.7074	0.6052	0.4999	0.3860	0.2870	0.1953	0.1350	0.1465	0.2380	0.4011	0.5911	0.7306	(89)
MIT 2	20.5284	20.5463	20.5535	20.5652	20.5674	20.5781	20.5781	20.5802	20.5738	20.5673	20.5592	20.5326	(90)
Living area fraction									fLA = Living area / (4) =			0.5576	(91)
MIT	20.7795	20.7958	20.8017	20.8076	20.8086	20.8133	20.8133	20.8143	20.8114	20.8085	20.8027	20.7792	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7795	20.7958	20.8017	20.8076	20.8086	20.8133	20.8133	20.8143	20.8114	20.8085	20.8027	20.7792	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7163	0.6142	0.5086	0.3940	0.2948	0.2030	0.1429	0.1547	0.2468	0.4108	0.6013	0.7392	(94)
Useful gains	387.8953	376.7106	338.5994	275.1878	209.4519	139.2173	94.4049	98.3874	151.9589	234.7094	317.0931	381.2564	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	394.4762	378.6309	338.9773	275.2187	209.4537	139.2174	94.4049	98.3874	151.9591	234.7458	318.3236	389.0512	(97)
Space heating kWh	4.8961	1.2904	0.2812	0.0223	0.0013	0.0000	0.0000	0.0000	0.0000	0.0271	0.8860	5.7993	(98a)
Space heating requirement - total per year (kWh/year)												13.2037	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	4.8961	1.2904	0.2812	0.0223	0.0013	0.0000	0.0000	0.0000	0.0000	0.0271	0.8860	5.7993	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												13.2037	
Space heating per m2											(98c) / (4) =	0.2580	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	4.8961	1.2904	0.2812	0.0223	0.0013	0.0000	0.0000	0.0000	0.0000	0.0271	0.8860	5.7993	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	4.8961	1.2904	0.2812	0.0223	0.0013	0.0000	0.0000	0.0000	0.0000	0.0271	0.8860	5.7993	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9074	8.0454	8.9074	8.6201	8.9074	8.6201	8.9074	8.9074	8.6201	8.9074	8.6201	8.9074	(231)
Lighting	15.4380	12.3850	11.1513	8.1699	6.3107	5.1559	5.7568	7.4829	9.7196	12.7526	14.4040	15.8671	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.1420	-19.3585	-31.6479	-40.1405	-47.3610	-45.6598	-44.9395	-40.4814	-32.9522	-23.8996	-14.0606	-10.2289	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4049	-5.5792	-12.2985	-20.4286	-28.5733	-29.3630	-28.9430	-23.3991	-15.9608	-8.4088	-3.3317	-1.8477	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												13.2037	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2207.2753	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	104.8780	(230a)
Total electricity for the above, kWh/year	104.8780	(231)
Electricity for lighting (calculated in Appendix L)	124.5936	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-543.4106	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1906.5401	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	13.2037	16.4900	2.1773	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	16.4900	363.9797	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	104.8780	16.4900	17.2944	(249)
Energy for lighting	124.5936	16.4900	20.5455	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-362.8720	16.4900	-59.8376	
PV Unit electricity exported	-180.5386	5.5900	-10.0921	
Total			-69.9297	(252)
Total energy cost			334.0672	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2505	(257)
SAP value		79.7288	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	13.2037	0.1616	2.1337	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2207.2753	0.1413	311.7942	(264)
Space and water heating			313.9279	(265)
Pumps, fans and electric keep-hot	104.8780	0.1387	14.5479	(267)
Energy for lighting	124.5936	0.1443	17.9827	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-362.8720	0.1322	-47.9727	
PV Unit electricity exported	-180.5386	0.1235	-22.2897	
Total			-70.2624	(269)
Total CO2, kg/year			276.1961	(272)
CO2 emissions per m2			5.4000	(273)
EI value			96.1516	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		51.1700	(1b)	x 2.4000	(2b) =	122.8080	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.1700						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		122.8080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	16.0600	7.8800	8.1800	0.1400	1.1452	14.0000	114.5200	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	10.8828			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			16.0600	0.0000	0.0000	20.0000	321.2000	(32)
Party Floor 1			51.1700			80.0000	4093.6000	(32d)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			79.3800			9.0000	714.4200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 10266.1400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	200.6281 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	1.3740 (36)
Point Thermal bridges (36a) =	0.0000
Total fabric heat loss (33) + (36) + (36a) =	12.2568 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.7983	11.7983	11.5628	10.8561	10.7383	10.2672	10.0316	10.0316	10.5027	11.0916	11.3272	11.2094	(38)
Heat transfer coeff	24.0552	24.0552	23.8196	23.1129	22.9951	22.5240	22.2885	22.2885	22.7596	23.3485	23.5840	23.4663	(39)
Average = Sum(39)m / 12 =												23.1914	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4701	0.4701	0.4655	0.4517	0.4494	0.4402	0.4356	0.4356	0.4448	0.4563	0.4609	0.4586	(40)
HLP (average)												0.4532	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7246 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.0608	71.9628	70.3629	67.3017	65.0426	62.5233	61.0913	62.6791	64.4197	67.1247	70.2516	72.7809	(42a)
Hot water usage for baths	22.9731	22.6319	22.1514	21.2656	20.6022	19.8667	19.4694	19.9465	20.4660	21.2530	22.1571	22.8954	(42b)
Hot water usage for other uses	32.2915	31.1172	29.9430	28.7688	27.5945	26.4203	26.4203	27.5945	28.7688	29.9430	31.1172	32.2915	(42c)
Average daily hot water use (litres/day)												118.0151	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.3253	125.7119	122.4573	117.3360	113.2393	108.8102	106.9810	110.2201	113.6544	118.3207	123.5260	127.9677	(44)
Energy conte	203.2359	179.0121	188.2123	160.6271	152.4419	133.7949	129.3842	136.4755	140.1472	160.5600	175.9854	200.3665	(45)
Energy content (annual)										Total = Sum(45)m =		1960.2433	
Distribution loss (46)m = 0.15 x (45)m	30.4854	26.8518	28.2318	24.0941	22.8663	20.0692	19.4076	20.4713	21.0221	24.0840	26.3978	30.0550	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
									Total per year (kWh/year) = Sum(64)m =			2207.2753	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	84.3606	74.6819	79.3652	69.6517	67.4716	60.7300	59.8049	62.1628	62.8422	70.1708	74.7583	83.4065	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.6375	15.6655	12.7400	9.6450	7.2098	6.0868	6.5770	8.5490	11.4745	14.5695	17.0047	18.1277	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	224.2868	226.6142	220.7492	208.2634	192.5023	177.6891	167.7930	165.4656	171.3306	183.8164	199.5774	214.3906	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	(71)
Water heating gains (Table 5)	113.3879	111.1337	106.6737	96.7385	90.6876	84.3472	80.3829	83.5521	87.2808	94.3157	103.8310	112.1055	(72)
Total internal gains	436.8760	434.9772	421.7267	396.2107	371.9635	349.6869	336.3167	339.1305	351.6496	374.2653	401.9770	426.1877	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(79)

Solar gains	95.2051	173.0844	247.4999	322.5774	357.6553	345.0938	336.8383	300.1802	265.5901	190.1488	117.1921	83.3220	(83)
Total gains	532.0811	608.0616	669.2266	718.7881	729.6188	694.7807	673.1549	639.3107	617.2397	564.4141	519.1691	509.5097	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	118.5486	118.5486	119.7210	123.3815	124.0134	126.6073	127.9454	127.9454	125.2970	122.1367	120.9168	121.5237	
alpha	8.9032	8.9032	8.9814	9.2254	9.2676	9.4405	9.5297	9.5297	9.3531	9.1424	9.0611	9.1016	
util living area	0.7538	0.6550	0.5470	0.4212	0.3246	0.2529	0.2020	0.2162	0.3024	0.4672	0.6492	0.7740	(86)
MIT	20.9702	20.9899	20.9978	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9996	20.9926	20.9661	(87)
Th 2	20.5483	20.5483	20.5526	20.5653	20.5674	20.5760	20.5802	20.5802	20.5717	20.5611	20.5568	20.5589	(88)
util rest of house	0.7369	0.6382	0.5313	0.4072	0.3110	0.2391	0.1881	0.2015	0.2866	0.4491	0.6302	0.7576	(89)
MIT 2	20.5170	20.5380	20.5504	20.5651	20.5674	20.5760	20.5802	20.5802	20.5717	20.5607	20.5495	20.5230	(90)
Living area fraction										fLA = Living area / (4) =		0.5576	(91)
MIT	20.7697	20.7900	20.7999	20.8075	20.8086	20.8124	20.8143	20.8143	20.8105	20.8054	20.7965	20.7701	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7697	20.7900	20.7999	20.8075	20.8086	20.8124	20.8143	20.8143	20.8105	20.8054	20.7965	20.7701	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7453	0.6472	0.5400	0.4150	0.3186	0.2468	0.1958	0.2097	0.2954	0.4592	0.6405	0.7655	(94)
Useful gains	396.5380	393.5486	361.3857	298.2777	232.4448	171.4613	131.8200	134.0489	182.3141	259.1802	332.5508	390.0548	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	405.8027	396.6690	362.0545	298.3300	232.4487	171.4615	131.8201	134.0489	182.3155	259.2946	334.8115	400.5712	(97)
Space heating kWh	6.8930	2.0969	0.4976	0.0377	0.0029	0.0000	0.0000	0.0000	0.0000	0.0851	1.6276	7.8241	(98a)
Space heating requirement - total per year (kWh/year)												19.0650	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	6.8930	2.0969	0.4976	0.0377	0.0029	0.0000	0.0000	0.0000	0.0000	0.0851	1.6276	7.8241	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												19.0650	
Space heating per m2											(98c) / (4) =	0.3726	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	6.8930	2.0969	0.4976	0.0377	0.0029	0.0000	0.0000	0.0000	0.0000	0.0851	1.6276	7.8241	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													

	6.8930	2.0969	0.4976	0.0377	0.0029	0.0000	0.0000	0.0000	0.0000	0.0851	1.6276	7.8241 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	8.9074	8.0454	8.9074	8.6201	8.9074	8.6201	8.9074	8.9074	8.6201	8.9074	8.6201	8.9074 (231)
Lighting	15.4380	12.3850	11.1513	8.1699	6.3107	5.1559	5.7568	7.4829	9.7196	12.7526	14.4040	15.8671 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-10.9944	-18.6173	-31.6417	-41.8588	-49.0561	-46.3351	-45.9986	-40.4939	-32.7321	-22.8868	-13.0643	-9.4500 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.0435	-5.2214	-12.2897	-22.0235	-30.4942	-30.1810	-30.2340	-23.4124	-15.7721	-7.8122	-2.9511	-1.6227 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	19.0650 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2207.2753 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	104.8780 (230a)
Total electricity for the above, kWh/year	104.8780 (231)
Electricity for lighting (calculated in Appendix L)	124.5936 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-547.1869 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1908.6251 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	19.0650	25.1600	4.7968	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	25.1600	555.3505	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	104.8780	25.1600	26.3873	(249)
Energy for lighting	124.5936	25.1600	31.3478	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1291	25.1600	-91.3633	
PV Unit electricity exported	-184.0578	5.8100	-10.6938	
Total			-102.0570	(252)
Total energy cost			515.8253	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	19.0650	0.1612	3.0737	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2207.2753	0.1413	311.7942	(264)
Space and water heating			314.8679	(265)
Pumps, fans and electric keep-hot	104.8780	0.1387	14.5479	(267)
Energy for lighting	124.5936	0.1443	17.9827	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1291	0.1319	-47.8936	
PV Unit electricity exported	-184.0578	0.1230	-22.6361	
Total			-70.5297	(269)
Total CO2, kg/year			276.8688	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	19.0650	1.5966	30.4390	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	1.5223	3360.2168	(278)
Space and water heating			3390.6558	(279)

Pumps, fans and electric keep-hot	104.8780	1.5128	158.6595 (281)
Energy for lighting	124.5936	1.5338	191.1059 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-363.1291	1.4873	-540.0823
PV Unit electricity exported	-184.0578	0.4513	-83.0740
Total			-623.1563 (283)
Total Primary energy kWh/year			3117.2649 (286)

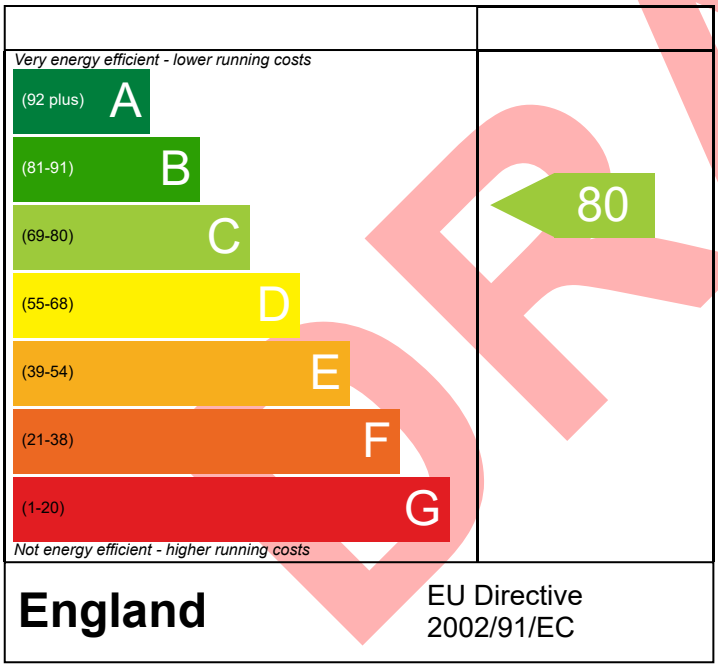
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	51.17 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

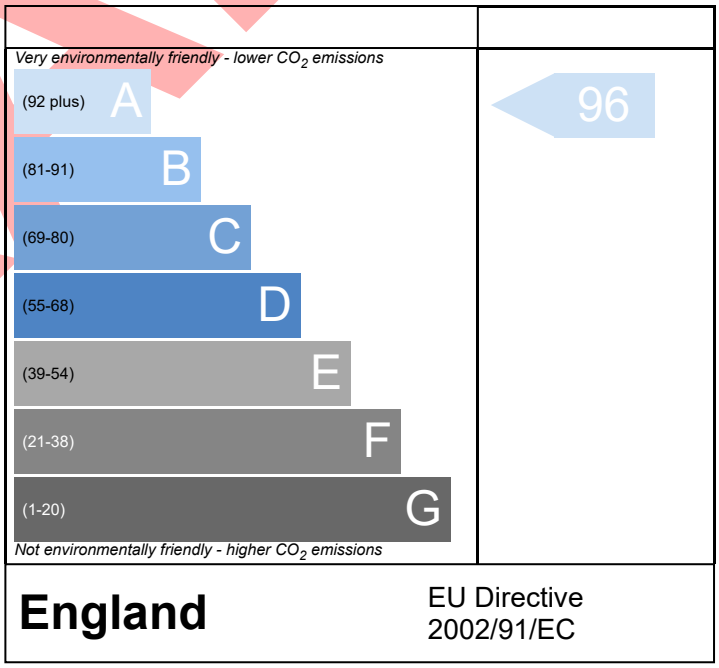
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:08

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	117 m^2
Site Reference	Unit 380 TH GF_Copy	Plot Reference	Unit 380 TH_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*10.73 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	4.78 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*57.41 kWh_{PE}/m^2*	
Dwelling primary energy	53.1 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*31.8 kWh/m^2*	
Dwelling fabric energy efficiency	29.1 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.12	Heatloss Floor 1 (0.12)	OK
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	69.54	0.14 **(!)**
Party wall: Party Wall (1)	25.42	0 **(!)**
Party wall: Party Wall (2)	71.68	0 **(!)**
Ground floor: Heatloss Floor 1, Heatloss Floor 1	52.63	0.12

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	15.75	South West	0.83	1.3
NW, Opening Type 1	11.81	North West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.16	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.08	
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0 **(!)**	
Party wall	P2: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.6 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	89%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	1.51 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 380 TH GF_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 380 TH_Copy	**Prop Type Ref**	Unit 380 TH GF
Property			

SAP Rating	77 C	**DER**	4.78	**TER**	10.73
Environmental	96 A	**% DER < TER**			55.45
CO_2 Emissions (t/year)	0.57	**DFEE**	29.13	**TFEE**	31.77
Compliance Check	See BREL	**% DFEE < TFEE**			8.29
% DPER < TPER	7.51	**DPER**	53.10	**TPER**	57.41

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.6300 (1b)	x	2.6700 (2b)	=	140.5221	(1b) - (3b)
First floor	64.3100 (1c)	x	2.7000 (2c)	=	173.6370	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	314.1591	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery	
If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	71.2000 (23c)

Effective ac	0.3066	0.3034	0.3002	0.2843	0.2811	0.2651	0.2651	0.2619	0.2715	0.2811	0.2874	0.2938	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			27.5600	1.2357	34.0570			(27)
Heatloss Floor 1			52.6300	0.1200	6.3156	75.0000	3947.2500	(28a)
External Wall 1	97.1000	27.5600	69.5400	0.1400	9.7356	14.0000	973.5600	(29a)
Total net area of external elements Aum(A, m2)			149.7300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.1082			(33)
Party Wall 1			25.4200	0.0000	0.0000	20.0000	508.4000	(32)
Wall to corridor			71.6800	0.0000	0.0000	20.0000	1433.6000	(32)
Party Ceiling 1			64.3100			80.0000	5144.8000	(32b)
Internal Wall 1			245.6100			9.0000	2210.4900	(32c)
Internal Floor 1			64.3100			0.0000	0.0000	(32d)
Internal Ceiling 1			52.6300			9.0000	473.6700	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14691.7700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		125.6351 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	11.8800	0.0500	0.5940	
E4 Jamb	32.4700	0.0500	1.6235	
E5 Ground floor (normal)	15.6000	0.1600	2.4960	
E18 Party wall between dwellings	6.0700	0.0600	0.3642	
P1 Party wall - Ground floor	15.6000	0.0800	1.2480	
E6 Intermediate floor within a dwelling	16.3700	0.0000	0.0000	
P2 Party wall - Intermediate floor within a dwelling	16.3700	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			6.3257	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	56.4339	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	31.7821	31.4516	31.1212	29.4689	29.1385	27.4862	27.4862	27.1557	28.1471	29.1385	29.7994	30.4603	(38)
Heat transfer coeff	88.2160	87.8856	87.5551	85.9028	85.5724	83.9201	83.9201	83.5897	84.5810	85.5724	86.2333	86.8942	(39)
Average = Sum(39)m / 12 =												85.8202	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7544	0.7515	0.7487	0.7346	0.7318	0.7176	0.7176	0.7148	0.7233	0.7318	0.7374	0.7431	(40)
HLP (average)												0.7339	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8507	(42)
Hot water usage for mixer showers	99.0223	97.5342	95.3657	91.2168	88.1549	84.7404	82.7996	84.9516	87.3107	90.9769	95.2150	98.6429	(42a)
Hot water usage for baths	31.0926	30.6308	29.9805	28.7816	27.8838	26.8883	26.3506	26.9963	27.6994	28.7646	29.9882	30.9874	(42b)
Hot water usage for other uses	43.8237	42.2302	40.6366	39.0430	37.4494	35.8558	35.8558	37.4494	39.0430	40.6366	42.2302	43.8237	(42c)
Average daily hot water use (litres/day)												159.9628	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	173.9387	170.3952	165.9828	159.0413	153.4881	147.4845	145.0059	149.3973	154.0530	160.3780	167.4333	173.4541	(44)
Energy conte	275.4763	242.6405	255.1095	217.7196	206.6245	181.3494	175.3721	184.9851	189.9628	217.6314	238.5395	271.5873	(45)
Energy content (annual)										Total = Sum(45)m =		2656.9977	
Distribution loss (46)m = 0.15 x (45)m	41.3214	36.3961	38.2664	32.6579	30.9937	27.2024	26.3058	27.7478	28.4944	32.6447	35.7809	40.7381	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	296.4571	261.5909	276.0903	238.0236	227.6053	201.6534	196.3529	205.9659	210.2668	238.6122	258.8435	292.5681	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	296.4571	261.5909	276.0903	238.0236	227.6053	201.6534	196.3529	205.9659	210.2668	238.6122	258.8435	292.5681	(64)
										Total per year (kWh/year) = Sum(64)m =		2904.0297	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	108.3805	95.8383	101.6085	88.6350	85.4873	76.5419	75.0959	78.2922	79.4058	89.1471	95.5576	107.0874	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	171.0404	171.0404	171.0404	171.0404	171.0404	171.0404	171.0404	171.0404	171.0404	171.0404	171.0404	171.0404	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.6659	29.0135	23.5954	17.8632	13.3530	11.2731	12.1810	15.8334	21.2515	26.9837	31.4939	33.5737	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	419.6630	424.0178	413.0439	389.6817	360.1911	332.4742	313.9575	309.6027	320.5766	343.9388	373.4294	401.1464	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.9547	54.9547	54.9547	54.9547	54.9547	54.9547	54.9547	54.9547	54.9547	54.9547	54.9547	54.9547	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-114.0269	-114.0269	-114.0269	-114.0269	-114.0269	-114.0269	-114.0269	-114.0269	-114.0269	-114.0269	-114.0269	-114.0269	(71)
Water heating gains (Table 5)	145.6727	142.6165	136.5706	123.1041	114.9023	106.3081	100.9353	105.2314	110.2859	119.8214	132.7189	143.9347	(72)
Total internal gains	709.9698	707.6160	685.1781	642.6172	600.4145	562.0236	539.0420	542.6357	564.0822	602.7120	649.6104	690.6230	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	15.7500	36.7938	0.6300	0.8270	0.7700	209.2353	(79)
Northwest	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(81)

Solar gains	257.3471	454.3380	664.0930	893.9924	1066.2876	1087.1424	1036.2336	903.3265	743.0205	513.5853	311.1527	218.3523	(83)
Total gains	967.3169	1161.9540	1349.2710	1536.6097	1666.7022	1649.1660	1575.2756	1445.9622	1307.1027	1116.2974	960.7631	908.9753	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	46.2620	46.4359	46.6112	47.5077	47.6912	48.6301	48.6301	48.8224	48.2502	47.6912	47.3257	46.9657	
alpha	4.0841	4.0957	4.1074	4.1672	4.1794	4.2420	4.2420	4.2548	4.2167	4.1794	4.1550	4.1310	
util living area	0.9302	0.8740	0.7790	0.6269	0.4659	0.3238	0.2340	0.2652	0.4381	0.7065	0.8836	0.9416	(86)
MIT	20.0169	20.3147	20.6247	20.8687	20.9666	20.9946	20.9990	20.9982	20.9810	20.8249	20.3970	19.9605	(87)
Th 2	20.2931	20.2955	20.2980	20.3104	20.3129	20.3253	20.3253	20.3278	20.3203	20.3129	20.3079	20.3029	(88)
util rest of house	0.9211	0.8597	0.7574	0.5986	0.4339	0.2902	0.1983	0.2267	0.3973	0.6738	0.8679	0.9338	(89)
MIT 2	19.1495	19.5158	19.8878	20.1765	20.2823	20.3212	20.3247	20.3267	20.3051	20.1376	19.6327	19.0873	(90)
Living area fraction									fLA = Living area / (4) =			0.3297	(91)
MIT	19.4354	19.7792	20.1307	20.4047	20.5079	20.5432	20.5470	20.5481	20.5279	20.3642	19.8847	19.3751	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4354	19.7792	20.1307	20.4047	20.5079	20.5432	20.5470	20.5481	20.5279	20.3642	19.8847	19.3751	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9083	0.8481	0.7520	0.6025	0.4431	0.3011	0.2100	0.2394	0.4099	0.6763	0.8571	0.9216	(94)
Useful gains	878.6314	985.5018	1014.6551	925.8539	738.4865	496.5710	330.8795	346.1327	535.7402	754.9520	823.5065	837.6781	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1335.1848	1307.6636	1193.4363	988.2881	753.7112	498.7542	331.2302	346.7388	543.6814	835.5461	1102.4657	1318.6320	(97)
Space heating kWh	339.6757	216.4927	133.0132	44.9526	11.3272	0.0000	0.0000	0.0000	0.0000	59.9620	200.8506	357.8297	(98a)
Space heating requirement - total per year (kWh/year)												1364.1037	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	339.6757	216.4927	133.0132	44.9526	11.3272	0.0000	0.0000	0.0000	0.0000	59.9620	200.8506	357.8297	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1364.1037	
Space heating per m2											(98c) / (4) =	11.6650	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	339.6757	216.4927	133.0132	44.9526	11.3272	0.0000	0.0000	0.0000	0.0000	59.9620	200.8506	357.8297	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	339.6757	216.4927	133.0132	44.9526	11.3272	0.0000	0.0000	0.0000	0.0000	59.9620	200.8506	357.8297	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	296.4571	261.5909	276.0903	238.0236	227.6053	201.6534	196.3529	205.9659	210.2668	238.6122	258.8435	292.5681	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	296.4571	261.5909	276.0903	238.0236	227.6053	201.6534	196.3529	205.9659	210.2668	238.6122	258.8435	292.5681	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	27.3437	24.6976	27.3437	26.4617	27.3437	26.4617	27.3437	27.3437	26.4617	27.3437	26.4617	27.3437	(231)
Lighting	28.5922	22.9377	20.6529	15.1312	11.6878	9.5490	10.6620	13.8588	18.0013	23.6186	26.6772	29.3869	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-27.8425	-43.9076	-70.1551	-86.0495	-98.9847	-94.3985	-92.9064	-84.3108	-69.5002	-52.3315	-31.8791	-23.4941	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-5.4390	-13.1469	-30.3890	-52.5251	-74.7436	-77.2445	-76.1278	-61.8402	-42.4068	-21.5863	-7.9124	-4.1358	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1364.1037	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2904.0297	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8400)		
mechanical ventilation fans (SFP = 0.8400)	321.9502	(230a)
Total electricity for the above, kWh/year	321.9502	(231)
Electricity for lighting (calculated in Appendix L)	230.7557	(232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1243.2576	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3577.5818	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1364.1037	16.4900	224.9407	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2904.0297	16.4900	478.8745	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	321.9502	16.4900	53.0896	(249)
Energy for lighting	230.7557	16.4900	38.0516	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-775.7601	16.4900	-127.9228	
PV Unit electricity exported	-467.4975	5.5900	-26.1331	
Total			-154.0559	(252)
Total energy cost			640.9005	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.4248	(257)
SAP value		76.9048	
SAP rating (Section 12)		77	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1364.1037	0.1577	215.0899	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2904.0297	0.1413	410.4396	(264)
Space and water heating			625.5296	(265)
Pumps, fans and electric keep-hot	321.9502	0.1387	44.6585	(267)
Energy for lighting	230.7557	0.1443	33.3052	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-775.7601	0.1328	-102.9910	
PV Unit electricity exported	-467.4975	0.1226	-57.2987	
Total			-160.2897	(269)
Total CO2, kg/year			543.2035	(272)
CO2 emissions per m2			4.6500	(273)
EI value			95.5052	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.6300 (1b)	x	2.6700 (2b)	=	140.5221	(1b) - (3b)
First floor	64.3100 (1c)	x	2.7000 (2c)	=	173.6370	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	314.1591	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes

Pressure Test Method	Blower Door	
Measured/design AP50	3.0000	(17)
Infiltration rate	0.1500	(18)
Number of sides sheltered	2	(19)
Shelter factor (20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	71.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3097	0.3097	0.3034	0.2843	0.2811	0.2683	0.2619	0.2619	0.2747	0.2906	0.2970	0.2938	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			27.5600	1.2357	34.0570			(27)
Heatloss Floor 1			52.6300	0.1200	6.3156	75.0000	3947.2500	(28a)
External Wall 1	97.1000	27.5600	69.5400	0.1400	9.7356	14.0000	973.5600	(29a)
Total net area of external elements Aum(A, m2)			149.7300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.1082			(33)
Party Wall 1			25.4200	0.0000	0.0000	20.0000	508.4000	(32)
Wall to corridor			71.6800	0.0000	0.0000	20.0000	1433.6000	(32)
Party Ceiling 1			64.3100			80.0000	5144.8000	(32b)
Internal Wall 1			245.6100			9.0000	2210.4900	(32c)
Internal Floor 1			64.3100			0.0000	0.0000	(32d)
Internal Ceiling 1			52.6300			9.0000	473.6700	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) =	14691.7700	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	125.6351	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.8800	0.0500	0.5940
E4 Jamb	32.4700	0.0500	1.6235
E5 Ground floor (normal)	15.6000	0.1600	2.4960
E18 Party wall between dwellings	6.0700	0.0600	0.3642
P1 Party wall - Ground floor	15.6000	0.0800	1.2480
E6 Intermediate floor within a dwelling	16.3700	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	16.3700	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.3257	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	56.4339	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.1126	32.1126	31.4516	29.4689	29.1385	27.8166	27.1557	27.1557	28.4775	30.1298	30.7907	30.4603	(38)
Heat transfer coeff	88.5465	88.5465	87.8856	85.9028	85.5724	84.2506	83.5897	83.5897	84.9115	86.5638	87.2247	86.8942	(39)
Average = Sum(39)m / 12 =												86.1231	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7572	0.7572	0.7515	0.7346	0.7318	0.7205	0.7148	0.7148	0.7261	0.7402	0.7459	0.7431	(40)
HLP (average)												0.7365	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8507	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	99.0223	97.5342	95.3657	91.2168	88.1549	84.7404	82.7996	84.9516	87.3107	90.9769	95.2150	98.6429	(42a)
Hot water usage for baths	31.0926	30.6308	29.9805	28.7816	27.8838	26.8883	26.3506	26.9963	27.6994	28.7646	29.9882	30.9874	(42b)
Hot water usage for other uses	43.8237	42.2302	40.6366	39.0430	37.4494	35.8558	35.8558	37.4494	39.0430	40.6366	42.2302	43.8237	(42c)
Average daily hot water use (litres/day)												159.9628	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	173.9387	170.3952	165.9828	159.0413	153.4881	147.4845	145.0059	149.3973	154.0530	160.3780	167.4333	173.4541	(44)
Energy conte	275.4763	242.6405	255.1095	217.7196	206.6245	181.3494	175.3721	184.9851	189.9628	217.6314	238.5395	271.5873	(45)
Energy content (annual)										Total = Sum(45)m =		2656.9977	
Distribution loss (46)m = 0.15 x (45)m	41.3214	36.3961	38.2664	32.6579	30.9937	27.2024	26.3058	27.7478	28.4944	32.6447	35.7809	40.7381	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	296.4571	261.5909	276.0903	238.0236	227.6053	201.6534	196.3529	205.9659	210.2668	238.6122	258.8435	292.5681	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	296.4571	261.5909	276.0903	238.0236	227.6053	201.6534	196.3529	205.9659	210.2668	238.6122	258.8435	292.5681	(64)
										Total per year (kWh/year) = Sum(64)m =		2904.0297	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
108.3805	95.8383	101.6085	88.6350	85.4873	76.5419	75.0959	78.2922	79.4058	89.1471	95.5576	107.0874	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m 171.0404	171.0404	171.0404	171.0404	171.0404	171.0404	171.0404	171.0404	171.0404	171.0404	171.0404	171.0404	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

32.6659	29.0135	23.5954	17.8632	13.3530	11.2731	12.1810	15.8334	21.2515	26.9837	31.4939	33.5737	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

419.6630	424.0178	413.0439	389.6817	360.1911	332.4742	313.9575	309.6027	320.5766	343.9388	373.4294	401.1464	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

54.9547	54.9547	54.9547	54.9547	54.9547	54.9547	54.9547	54.9547	54.9547	54.9547	54.9547	54.9547	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-114.0269	-114.0269	-114.0269	-114.0269	-114.0269	-114.0269	-114.0269	-114.0269	-114.0269	-114.0269	-114.0269	-114.0269	(71)

Water heating gains (Table 5)

145.6727	142.6165	136.5706	123.1041	114.9023	106.3081	100.9353	105.2314	110.2859	119.8214	132.7189	143.9347	(72)

Total internal gains

709.9698	707.6160	685.1781	642.6172	600.4145	562.0236	539.0420	542.6357	564.0822	602.7120	649.6104	690.6230	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	15.7500	33.4622	0.6300	0.8270	0.7700	190.2894	(79)
Northwest	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(81)

Solar gains	233.0625	438.5514	668.7407	946.3280	1118.1488	1108.7858	1069.6235	905.8613	741.1645	492.4156	289.4820	202.3043	(83)
Total gains	943.0323	1146.1674	1353.9188	1588.9453	1718.5633	1670.8095	1608.6655	1448.4970	1305.2466	1095.1276	939.0923	892.9273	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	46.0893	46.0893	46.4359	47.5077	47.6912	48.4394	48.8224	48.8224	48.0624	47.1450	46.7878	46.9657	
alpha	4.0726	4.0726	4.0957	4.1672	4.1794	4.2293	4.2548	4.2548	4.2042	4.1430	4.1192	4.1310	
util living area	0.9397	0.8901	0.8036	0.6492	0.4970	0.3887	0.3153	0.3549	0.5150	0.7576	0.9016	0.9493	(86)
MIT	19.9244	20.2147	20.5445	20.8382	20.9530	20.9865	20.9954	20.9927	20.9584	20.7442	20.2962	19.8716	(87)
Th 2	20.2906	20.2906	20.2955	20.3104	20.3129	20.3228	20.3278	20.3278	20.3178	20.3054	20.3005	20.3029	(88)
util rest of house	0.9318	0.8775	0.7844	0.6230	0.4669	0.3561	0.2811	0.3173	0.4764	0.7288	0.8880	0.9426	(89)
MIT 2	19.0322	19.3892	19.7900	20.1416	20.2681	20.3115	20.3244	20.3223	20.2811	20.0404	19.5038	18.9756	(90)
Living area fraction									fLA = Living area / (4) =			0.3297	(91)
MIT	19.3263	19.6613	20.0387	20.3713	20.4939	20.5340	20.5456	20.5433	20.5044	20.2724	19.7650	19.2710	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3263	19.6613	20.0387	20.3713	20.4939	20.5340	20.5456	20.5433	20.5044	20.2724	19.7650	19.2710	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9192	0.8650	0.7769	0.6254	0.4749	0.3663	0.2922	0.3294	0.4871	0.7274	0.8762	0.9307	(94)
Useful gains	866.8269	991.4358	1051.8328	993.6654	816.2084	612.0649	470.1068	477.1495	635.8025	796.5889	822.8649	831.0474	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	1365.9441	1360.1919	1268.9550	1071.3160	838.0883	617.8950	471.9166	480.0813	654.1901	915.1878	1148.3164	1353.0266	(97)
Space heating kWh	371.3431	247.8041	161.5389	55.9084	16.2786	0.0000	0.0000	0.0000	0.0000	88.2376	234.3251	388.3525	(98a)
Space heating requirement - total per year (kWh/year)												1563.7883	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	371.3431	247.8041	161.5389	55.9084	16.2786	0.0000	0.0000	0.0000	0.0000	88.2376	234.3251	388.3525	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1563.7883	
Space heating per m2											(98c) / (4) =	13.3726	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	371.3431	247.8041	161.5389	55.9084	16.2786	0.0000	0.0000	0.0000	0.0000	88.2376	234.3251	388.3525	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	371.3431	247.8041	161.5389	55.9084	16.2786	0.0000	0.0000	0.0000	0.0000	88.2376	234.3251	388.3525	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	296.4571	261.5909	276.0903	238.0236	227.6053	201.6534	196.3529	205.9659	210.2668	238.6122	258.8435	292.5681	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	296.4571	261.5909	276.0903	238.0236	227.6053	201.6534	196.3529	205.9659	210.2668	238.6122	258.8435	292.5681	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	27.3437	24.6976	27.3437	26.4617	27.3437	26.4617	27.3437	27.3437	26.4617	27.3437	26.4617	27.3437	(231)
Lighting	28.5922	22.9377	20.6529	15.1312	11.6878	9.5490	10.6620	13.8588	18.0013	23.6186	26.6772	29.3869	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-25.2635	-42.4273	-70.5943	-89.9612	-102.5674	-95.6966	-94.9407	-84.3352	-69.0600	-50.5487	-29.7560	-21.7432	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-4.5655	-12.1128	-29.9154	-56.1938	-79.4341	-79.3629	-79.4704	-61.8746	-41.9118	-19.6870	-6.8853	-3.5897	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1563.7883	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2904.0297	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8400)		
mechanical ventilation fans (SFP = 0.8400)	321.9502	(230a)
Total electricity for the above, kWh/year	321.9502	(231)
Electricity for lighting (calculated in Appendix L)	230.7557	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1251.8972	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3768.6268	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1563.7883	25.1600	393.4491	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2904.0297	25.1600	730.6539	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	321.9502	25.1600	81.0027	(249)
Energy for lighting	230.7557	25.1600	58.0581	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-776.8940	25.1600	-195.4665	
PV Unit electricity exported	-475.0032	5.8100	-27.5977	
Total			-223.0642	(252)
Total energy cost			1040.0996	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1563.7883	0.1571	245.7216	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2904.0297	0.1413	410.4396	(264)
Space and water heating			656.1612	(265)
Pumps, fans and electric keep-hot	321.9502	0.1387	44.6585	(267)
Energy for lighting	230.7557	0.1443	33.3052	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-776.8940	0.1325	-102.9154	
PV Unit electricity exported	-475.0032	0.1220	-57.9521	
Total			-160.8674	(269)
Total CO2, kg/year			573.2574	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1563.7883	1.5817	2473.3880	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2904.0297	1.5226	4421.7497	(278)
Space and water heating			6895.1377	(279)
Pumps, fans and electric keep-hot	321.9502	1.5128	487.0463	(281)
Energy for lighting	230.7557	1.5338	353.9408	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-776.8940	1.4895	-1157.1688	
PV Unit electricity exported	-475.0032	0.4477	-212.6617	

Total	-1369.8305 (283)
Total Primary energy kWh/year	6366.2943 (286)

SAP 10 EPC IMPROVEMENTS

Unit 380 TH_Copy

Current energy efficiency rating:	C 77
Current environmental impact rating:	A 96

N Solar water heating	Not applicable
U Solar photovoltaic panels	Not applicable
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating:	C 77
Potential environmental impact rating:	A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£1263	£1263	£0
Space heating	£474	£474	£0
Water heating	£731	£731	£0
Lighting	£58	£58	£0
Generated (PV)	-£223	-£223	£0
Total cost of fuels	£1040	£1040	£0
Total cost of uses	£1040	£1040	£0
Delivered energy	32 kWh/m²	32 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.6 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	54 kWh/m²	54 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.6300 (1b)	x	2.6700 (2b)	=	140.5221	(1b) - (3b)
First floor	64.3100 (1c)	x	2.7000 (2c)	=	173.6370	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	314.1591	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													

	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 71.2000 (23c)

Effective ac	0.3066	0.3034	0.3002	0.2843	0.2811	0.2651	0.2651	0.2619	0.2715	0.2811	0.2874	0.2938 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			27.5600	1.2357	34.0570			(27)
Heatloss Floor 1			52.6300	0.1200	6.3156	75.0000	3947.2500	(28a)
External Wall 1	97.1000	27.5600	69.5400	0.1400	9.7356	14.0000	973.5600	(29a)
Total net area of external elements Aum(A, m2)			149.7300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.1082			(33)
Party Wall 1			25.4200	0.0000	0.0000	20.0000	508.4000	(32)
Wall to corridor			71.6800	0.0000	0.0000	20.0000	1433.6000	(32)
Party Ceiling 1			64.3100			80.0000	5144.8000	(32b)
Internal Wall 1			245.6100			9.0000	2210.4900	(32c)
Internal Floor 1			64.3100			0.0000	0.0000	(32d)
Internal Ceiling 1			52.6300			9.0000	473.6700	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14691.7700 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 125.6351 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.8800	0.0500	0.5940
E4 Jamb	32.4700	0.0500	1.6235
E5 Ground floor (normal)	15.6000	0.1600	2.4960
E18 Party wall between dwellings	6.0700	0.0600	0.3642
P1 Party wall - Ground floor	15.6000	0.0800	1.2480
E6 Intermediate floor within a dwelling	16.3700	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	16.3700	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.3257 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 56.4339 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	31.7821	31.4516	31.1212	29.4689	29.1385	27.4862	27.4862	27.1557	28.1471	29.1385	29.7994	30.4603	(38)
Heat transfer coeff	88.2160	87.8856	87.5551	85.9028	85.5724	83.9201	83.9201	83.5897	84.5810	85.5724	86.2333	86.8942	(39)

Average = Sum(39)m / 12 = 85.8202

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7544	0.7515	0.7487	0.7346	0.7318	0.7176	0.7176	0.7148	0.7233	0.7318	0.7374	0.7431	(40)
HLP (average)												0.7339	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8507 (42)

Hot water usage for mixer showers

	99.0223	97.5342	95.3657	91.2168	88.1549	84.7404	82.7996	84.9516	87.3107	90.9769	95.2150	98.6429 (42a)

Hot water usage for baths

	31.0926	30.6308	29.9805	28.7816	27.8838	26.8883	26.3506	26.9963	27.6994	28.7646	29.9882	30.9874 (42b)

Hot water usage for other uses

	43.8237	42.2302	40.6366	39.0430	37.4494	35.8558	35.8558	37.4494	39.0430	40.6366	42.2302	43.8237 (42c)

Average daily hot water use (litres/day) 159.9628 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	173.9387	170.3952	165.9828	159.0413	153.4881	147.4845	145.0059	149.3973	154.0530	160.3780	167.4333	173.4541	(44)
Energy conte	275.4763	242.6405	255.1095	217.7196	206.6245	181.3494	175.3721	184.9851	189.9628	217.6314	238.5395	271.5873	(45)
Energy content (annual)										Total = Sum(45)m =		2656.9977	
Distribution loss (46)m = 0.15 x (45)m	41.3214	36.3961	38.2664	32.6579	30.9937	27.2024	26.3058	27.7478	28.4944	32.6447	35.7809	40.7381	(46)

Water storage loss:

Store volume 143.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)

Temperature factor from Table 2b 0.6000 (49)

Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808 (56)

If cylinder contains dedicated solar storage

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)

Total heat required for water heating calculated for each month

	296.4571	261.5909	276.0903	238.0236	227.6053	201.6534	196.3529	205.9659	210.2668	238.6122	258.8435	292.5681 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

Output from w/h

	296.4571	261.5909	276.0903	238.0236	227.6053	201.6534	196.3529	205.9659	210.2668	238.6122	258.8435	292.5681 (64)
										Total per year (kWh/year) = Sum(64)m =		2904.0297 (64)

Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

	108.3805	95.8383	101.6085	88.6350	85.4873	76.5419	75.0959	78.2922	79.4058	89.1471	95.5576	107.0874 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	171.0404	171.0404	171.0404	171.0404	171.0404	171.0404	171.0404	171.0404	171.0404	171.0404	171.0404	171.0404	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	32.6659	29.0135	23.5954	17.8632	13.3530	11.2731	12.1810	15.8334	21.2515	26.9837	31.4939	33.5737 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	419.6630	424.0178	413.0439	389.6817	360.1911	332.4742	313.9575	309.6027	320.5766	343.9388	373.4294	401.1464 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	54.9547	54.9547	54.9547	54.9547	54.9547	54.9547	54.9547	54.9547	54.9547	54.9547	54.9547	54.9547 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-114.0269	-114.0269	-114.0269	-114.0269	-114.0269	-114.0269	-114.0269	-114.0269	-114.0269	-114.0269	-114.0269	-114.0269 (71)
Water heating gains (Table 5)												
	145.6727	142.6165	136.5706	123.1041	114.9023	106.3081	100.9353	105.2314	110.2859	119.8214	132.7189	143.9347 (72)
Total internal gains												
	709.9698	707.6160	685.1781	642.6172	600.4145	562.0236	539.0420	542.6357	564.0822	602.7120	649.6104	690.6230 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	15.7500	36.7938	0.6300	0.8270	0.7700	209.2353	(79)
Northwest	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(81)

Solar gains	257.3471	454.3380	664.0930	893.9924	1066.2876	1087.1424	1036.2336	903.3265	743.0205	513.5853	311.1527	218.3523 (83)
Total gains	967.3169	1161.9540	1349.2710	1536.6097	1666.7022	1649.1660	1575.2756	1445.9622	1307.1027	1116.2974	960.7631	908.9753 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	46.2620	46.4359	46.6112	47.5077	47.6912	48.6301	48.6301	48.8224	48.2502	47.6912	47.3257	46.9657	
alpha	4.0841	4.0957	4.1074	4.1672	4.1794	4.2420	4.2420	4.2548	4.2167	4.1794	4.1550	4.1310	
util living area													
	0.9302	0.8740	0.7790	0.6269	0.4659	0.3238	0.2340	0.2652	0.4381	0.7065	0.8836	0.9416	(86)
MIT	20.0169	20.3147	20.6247	20.8687	20.9666	20.9946	20.9990	20.9982	20.9810	20.8249	20.3970	19.9605	(87)
Th 2	20.2931	20.2955	20.2980	20.3104	20.3129	20.3253	20.3253	20.3278	20.3203	20.3129	20.3079	20.3029	(88)
util rest of house													
	0.9211	0.8597	0.7574	0.5986	0.4339	0.2902	0.1983	0.2267	0.3973	0.6738	0.8679	0.9338	(89)
MIT 2	19.1495	19.5158	19.8878	20.1765	20.2823	20.3212	20.3247	20.3267	20.3051	20.1376	19.6327	19.0873	(90)
Living area fraction										fLA = Living area / (4) =		0.3297	(91)
MIT	19.4354	19.7792	20.1307	20.4047	20.5079	20.5432	20.5470	20.5481	20.5279	20.3642	19.8847	19.3751	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4354	19.7792	20.1307	20.4047	20.5079	20.5432	20.5470	20.5481	20.5279	20.3642	19.8847	19.3751	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9083	0.8481	0.7520	0.6025	0.4431	0.3011	0.2100	0.2394	0.4099	0.6763	0.8571	0.9216	(94)
Useful gains	878.6314	985.5018	1014.6551	925.8539	738.4865	496.5710	330.8795	346.1327	535.7402	754.9520	823.5065	837.6781	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1335.1848	1307.6636	1193.4363	988.2881	753.7112	498.7542	331.2302	346.7388	543.6814	835.5461	1102.4657	1318.6320	(97)
Space heating kWh													
	339.6757	216.4927	133.0132	44.9526	11.3272	0.0000	0.0000	0.0000	0.0000	59.9620	200.8506	357.8297	(98a)
Space heating requirement - total per year (kWh/year)												1364.1037	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	339.6757	216.4927	133.0132	44.9526	11.3272	0.0000	0.0000	0.0000	0.0000	59.9620	200.8506	357.8297	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1364.1037	
Space heating per m2											(98c) / (4) =	11.6650	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	339.6757	216.4927	133.0132	44.9526	11.3272	0.0000	0.0000	0.0000	0.0000	59.9620	200.8506	357.8297	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	339.6757	216.4927	133.0132	44.9526	11.3272	0.0000	0.0000	0.0000	0.0000	59.9620	200.8506	357.8297	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	296.4571	261.5909	276.0903	238.0236	227.6053	201.6534	196.3529	205.9659	210.2668	238.6122	258.8435	292.5681	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	296.4571	261.5909	276.0903	238.0236	227.6053	201.6534	196.3529	205.9659	210.2668	238.6122	258.8435	292.5681	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	27.3437	24.6976	27.3437	26.4617	27.3437	26.4617	27.3437	27.3437	26.4617	27.3437	26.4617	27.3437	(231)
Lighting	28.5922	22.9377	20.6529	15.1312	11.6878	9.5490	10.6620	13.8588	18.0013	23.6186	26.6772	29.3869	(232)

Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-27.8425	-43.9076	-70.1551	-86.0495	-98.9847	-94.3985	-92.9064	-84.3108	-69.5002	-52.3315	-31.8791	-23.4941 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-5.4390	-13.1469	-30.3890	-52.5251	-74.7436	-77.2445	-76.1278	-61.8402	-42.4068	-21.5863	-7.9124	-4.1358 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1364.1037	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2904.0297	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8400)		
mechanical ventilation fans (SFP = 0.8400)	321.9502	(230a)
Total electricity for the above, kWh/year	321.9502	(231)
Electricity for lighting (calculated in Appendix L)	230.7557	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1243.2576	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3577.5818	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1364.1037	16.4900	224.9407	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2904.0297	16.4900	478.8745	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	321.9502	16.4900	53.0896	(249)
Energy for lighting	230.7557	16.4900	38.0516	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-775.7601	16.4900	-127.9228	
PV Unit electricity exported	-467.4975	5.5900	-26.1331	
Total			-154.0559	(252)
Total energy cost			640.9005	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.4248	(257)
SAP value		76.9048	
SAP rating (Section 12)		77	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1364.1037	0.1577	215.0899	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2904.0297	0.1413	410.4396	(264)
Space and water heating			625.5296	(265)
Pumps, fans and electric keep-hot	321.9502	0.1387	44.6585	(267)
Energy for lighting	230.7557	0.1443	33.3052	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-775.7601	0.1328	-102.9910	
PV Unit electricity exported	-467.4975	0.1226	-57.2987	
Total			-160.2897	(269)
Total CO2, kg/year			543.2035	(272)
CO2 emissions per m2			4.6500	(273)
EI value			95.5052	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.6300 (1b)	x	2.6700 (2b)	=	140.5221	(1b) - (3b)
First floor	64.3100 (1c)	x	2.7000 (2c)	=	173.6370	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	314.1591	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	71.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3097	0.3097	0.3034	0.2843	0.2811	0.2683	0.2619	0.2619	0.2747	0.2906	0.2970	0.2938	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			27.5600	1.2357	34.0570			(27)
Heatloss Floor 1			52.6300	0.1200	6.3156	75.0000	3947.2500	(28a)
External Wall 1	97.1000	27.5600	69.5400	0.1400	9.7356	14.0000	973.5600	(29a)
Total net area of external elements Aum(A, m2)			149.7300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.1082			(33)
Party Wall 1			25.4200	0.0000	0.0000	20.0000	508.4000	(32)
Wall to corridor			71.6800	0.0000	0.0000	20.0000	1433.6000	(32)
Party Ceiling 1			64.3100			80.0000	5144.8000	(32b)
Internal Wall 1			245.6100			9.0000	2210.4900	(32c)
Internal Floor 1			64.3100			0.0000	0.0000	(32d)
Internal Ceiling 1			52.6300			9.0000	473.6700	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 14691.7700	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	125.6351	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.8800	0.0500	0.5940
E4 Jamb	32.4700	0.0500	1.6235
E5 Ground floor (normal)	15.6000	0.1600	2.4960
E18 Party wall between dwellings	6.0700	0.0600	0.3642
P1 Party wall - Ground floor	15.6000	0.0800	1.2480
E6 Intermediate floor within a dwelling	16.3700	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	16.3700	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.3257	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	56.4339	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.1126	32.1126	31.4516	29.4689	29.1385	27.8166	27.1557	27.1557	28.4775	30.1298	30.7907	30.4603	(38)
Heat transfer coeff	88.5465	88.5465	87.8856	85.9028	85.5724	84.2506	83.5897	83.5897	84.9115	86.5638	87.2247	86.8942	(39)
Average = Sum(39)m / 12 =												86.1231	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7572	0.7572	0.7515	0.7346	0.7318	0.7205	0.7148	0.7148	0.7261	0.7402	0.7459	0.7431	(40)
HLP (average)												0.7365	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8507	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
99.0223	97.5342	95.3657	91.2168	88.1549	84.7404	82.7996	84.9516	87.3107	90.9769	95.2150	98.6429	(42a)

Hot water usage for baths

31.0926	30.6308	29.9805	28.7816	27.8838	26.8883	26.3506	26.9963	27.6994	28.7646	29.9882	30.9874	(42b)

Hot water usage for other uses

43.8237	42.2302	40.6366	39.0430	37.4494	35.8558	35.8558	37.4494	39.0430	40.6366	42.2302	43.8237	(42c)

Average daily hot water use (litres/day)	159.9628	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	173.9387	170.3952	165.9828	159.0413	153.4881	147.4845	145.0059	149.3973	154.0530	160.3780	167.4333	173.4541	(44)
Energy conte	275.4763	242.6405	255.1095	217.7196	206.6245	181.3494	175.3721	184.9851	189.9628	217.6314	238.5395	271.5873	(45)
Energy content (annual)											Total = Sum(45)m =	2656.9977	
Distribution loss (46)m = 0.15 x (45)m													
	41.3214	36.3961	38.2664	32.6579	30.9937	27.2024	26.3058	27.7478	28.4944	32.6447	35.7809	40.7381	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	296.4571	261.5909	276.0903	238.0236	227.6053	201.6534	196.3529	205.9659	210.2668	238.6122	258.8435	292.5681	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	296.4571	261.5909	276.0903	238.0236	227.6053	201.6534	196.3529	205.9659	210.2668	238.6122	258.8435	292.5681	(64)
										Total per year (kWh/year) = Sum(64)m =		2904.0297	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
							Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =					0.0000	(64a)
Heat gains from water heating, kWh/month													
	108.3805	95.8383	101.6085	88.6350	85.4873	76.5419	75.0959	78.2922	79.4058	89.1471	95.5576	107.0874	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	171.0404	171.0404	171.0404	171.0404	171.0404	171.0404	171.0404	171.0404	171.0404	171.0404	171.0404	171.0404	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	32.6659	29.0135	23.5954	17.8632	13.3530	11.2731	12.1810	15.8334	21.2515	26.9837	31.4939	33.5737	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	419.6630	424.0178	413.0439	389.6817	360.1911	332.4742	313.9575	309.6027	320.5766	343.9388	373.4294	401.1464	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9547	54.9547	54.9547	54.9547	54.9547	54.9547	54.9547	54.9547	54.9547	54.9547	54.9547	54.9547	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.0269	-114.0269	-114.0269	-114.0269	-114.0269	-114.0269	-114.0269	-114.0269	-114.0269	-114.0269	-114.0269	-114.0269	(71)
Water heating gains (Table 5)													
	145.6727	142.6165	136.5706	123.1041	114.9023	106.3081	100.9353	105.2314	110.2859	119.8214	132.7189	143.9347	(72)
Total internal gains													
	709.9698	707.6160	685.1781	642.6172	600.4145	562.0236	539.0420	542.6357	564.0822	602.7120	649.6104	690.6230	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	15.7500	33.4622	0.6300	0.8270	0.7700	190.2894	(79)
Northwest	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(81)

Solar gains	233.0625	438.5514	668.7407	946.3280	1118.1488	1108.7858	1069.6235	905.8613	741.1645	492.4156	289.4820	202.3043	(83)
Total gains	943.0323	1146.1674	1353.9188	1588.9453	1718.5633	1670.8095	1608.6655	1448.4970	1305.2466	1095.1276	939.0923	892.9273	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	46.0893	46.0893	46.4359	47.5077	47.6912	48.4394	48.8224	48.8224	48.0624	47.1450	46.7878	46.9657	
alpha	4.0726	4.0726	4.0957	4.1672	4.1794	4.2293	4.2548	4.2548	4.2042	4.1430	4.1192	4.1310	
util living area													
	0.9397	0.8901	0.8036	0.6492	0.4970	0.3887	0.3153	0.3549	0.5150	0.7576	0.9016	0.9493	(86)
MIT	19.9244	20.2147	20.5445	20.8382	20.9530	20.9865	20.9954	20.9927	20.9584	20.7442	20.2962	19.8716	(87)
Th 2	20.2906	20.2906	20.2955	20.3104	20.3129	20.3228	20.3278	20.3278	20.3178	20.3054	20.3005	20.3029	(88)
util rest of house													
	0.9318	0.8775	0.7844	0.6230	0.4669	0.3561	0.2811	0.3173	0.4764	0.7288	0.8880	0.9426	(89)
MIT 2	19.0322	19.3892	19.7900	20.1416	20.2681	20.3115	20.3244	20.3223	20.2811	20.0404	19.5038	18.9756	(90)
Living area fraction									fLA = Living area / (4) =			0.3297	(91)
MIT	19.3263	19.6613	20.0387	20.3713	20.4939	20.5340	20.5456	20.5433	20.5044	20.2724	19.7650	19.2710	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3263	19.6613	20.0387	20.3713	20.4939	20.5340	20.5456	20.5433	20.5044	20.2724	19.7650	19.2710	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9192	0.8650	0.7769	0.6254	0.4749	0.3663	0.2922	0.3294	0.4871	0.7274	0.8762	0.9307	(94)
Useful gains	866.8269	991.4358	1051.8328	993.6654	816.2084	612.0649	470.1068	477.1495	635.8025	796.5889	822.8649	831.0474	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	1365.9441	1360.1919	1268.9550	1071.3160	838.0883	617.8950	471.9166	480.0813	654.1901	915.1878	1148.3164	1353.0266	(97)
Space heating kWh													
	371.3431	247.8041	161.5389	55.9084	16.2786	0.0000	0.0000	0.0000	0.0000	88.2376	234.3251	388.3525	(98a)
Space heating requirement - total per year (kWh/year)												1563.7883	
Solar heating kWh													

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)											0.0000	
Space heating kWh												
	371.3431	247.8041	161.5389	55.9084	16.2786	0.0000	0.0000	0.0000	0.0000	88.2376	234.3251	388.3525 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)											1563.7883	
Space heating per m2										(98c) / (4) =	13.3726	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)											0.0000	(201)
Fraction of space heat from main system(s)											1.0000	(202)
Efficiency of main space heating system 1 (in %)											100.0000	(206)
Efficiency of main space heating system 2 (in %)											0.0000	(207)
Efficiency of secondary/supplementary heating system, %											0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	371.3431	247.8041	161.5389	55.9084	16.2786	0.0000	0.0000	0.0000	0.0000	88.2376	234.3251	388.3525	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	371.3431	247.8041	161.5389	55.9084	16.2786	0.0000	0.0000	0.0000	0.0000	88.2376	234.3251	388.3525	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	296.4571	261.5909	276.0903	238.0236	227.6053	201.6534	196.3529	205.9659	210.2668	238.6122	258.8435	292.5681	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	296.4571	261.5909	276.0903	238.0236	227.6053	201.6534	196.3529	205.9659	210.2668	238.6122	258.8435	292.5681	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	27.3437	24.6976	27.3437	26.4617	27.3437	26.4617	27.3437	27.3437	26.4617	27.3437	26.4617	27.3437	(231)
Lighting	28.5922	22.9377	20.6529	15.1312	11.6878	9.5490	10.6620	13.8588	18.0013	23.6186	26.6772	29.3869	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-25.2635	-42.4273	-70.5943	-89.9612	-102.5674	-95.6966	-94.9407	-84.3352	-69.0600	-50.5487	-29.7560	-21.7432	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-4.5655	-12.1128	-29.9154	-56.1938	-79.4341	-79.3629	-79.4704	-61.8746	-41.9118	-19.6870	-6.8853	-3.5897	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1563.7883	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2904.0297	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8400)													
mechanical ventilation fans (SFP = 0.8400)												321.9502	(230a)
Total electricity for the above, kWh/year												321.9502	(231)
Electricity for lighting (calculated in Appendix L)												230.7557	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1251.8972	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3768.6268	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1563.7883	25.1600	393.4491	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2904.0297	25.1600	730.6539	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	321.9502	25.1600	81.0027	(249)
Energy for lighting	230.7557	25.1600	58.0581	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-776.8940	25.1600	-195.4665	
PV Unit electricity exported	-475.0032	5.8100	-27.5977	
Total			-223.0642	(252)
Total energy cost			1040.0996	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	

Space heating - main system 1	1563.7883	0.1571	245.7216	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2904.0297	0.1413	410.4396	(264)
Space and water heating			656.1612	(265)
Pumps, fans and electric keep-hot	321.9502	0.1387	44.6585	(267)
Energy for lighting	230.7557	0.1443	33.3052	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-776.8940	0.1325	-102.9154	
PV Unit electricity exported	-475.0032	0.1220	-57.9521	
Total			-160.8674	(269)
Total CO2, kg/year			573.2574	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1563.7883	1.5817	2473.3880	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2904.0297	1.5226	4421.7497	(278)
Space and water heating			6895.1377	(279)
Pumps, fans and electric keep-hot	321.9502	1.5128	487.0463	(281)
Energy for lighting	230.7557	1.5338	353.9408	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-776.8940	1.4895	-1157.1688	
PV Unit electricity exported	-475.0032	0.4477	-212.6617	
Total			-1369.8305	(283)
Total Primary energy kWh/year			6366.2943	(286)

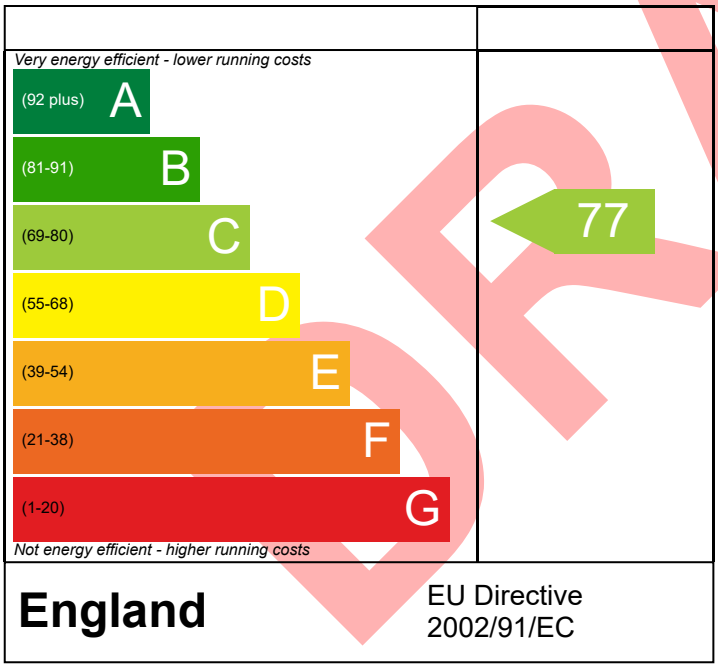
Predicted Energy Assessment

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	116.94 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

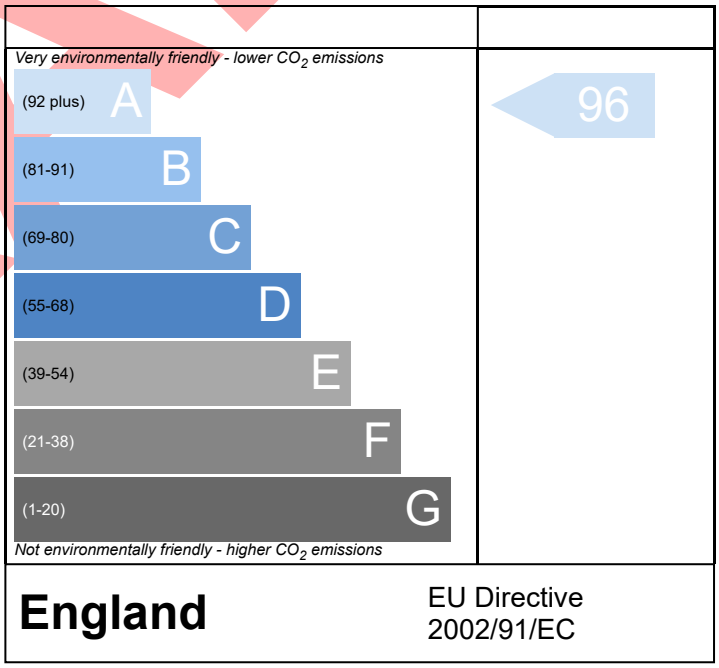
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:09

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	81 m^2
Site Reference	Unit 382 TH GF_Copy	Plot Reference	Unit 382 TH_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*10.51 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	4.69 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*56.58 kWh$_{PE}$/m^2*	
Dwelling primary energy	52.79 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*22.1 kWh/m^2*	
Dwelling fabric energy efficiency	20.4 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.12	Heatloss Floor 1 (0.12)	OK
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	19.08	0.14 **(!)**
Party wall: Party Wall (1)	41.38	0 **(!)**
Party wall: Party Wall (2)	82.85	0 **(!)**
Ground floor: Heatloss Floor 1, Heatloss Floor 1	35.28	0.12

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	15.06	South West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.16	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.08	
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0 **(!)**	
Party wall	P2: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	1.05 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 382 TH GF_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 382 TH_Copy	**Prop Type Ref**	Unit 382 TH GF
Property			

SAP Rating	79 C	**DER**	4.69	**TER**	10.51
Environmental	96 A	**% DER < TER**			55.38
CO_2 Emissions (t/year)	0.38	**DFEE**	20.36	**TFEE**	22.09
Compliance Check	See BREL	**% DFEE < TFEE**			7.84
% DPER < TPER	6.69	**DPER**	52.79	**TPER**	56.58

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	35.2800 (1b)	x	2.6700 (2b)	=	94.1976	(1b) - (3b)
First floor	45.8800 (1c)	x	2.7000 (2c)	=	123.8760	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.1600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	218.0736	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.0600	1.2357	18.6103			(27)
Heatloss Floor 1			35.2800	0.1200	4.2336	75.0000	2646.0000	(28a)
External Wall 1	34.1400	15.0600	19.0800	0.1400	2.6712	14.0000	267.1200	(29a)
Total net area of external elements Aum(A, m2)			69.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.5151			(33)
Party Wall 1			41.3800	0.0000	0.0000	20.0000	827.6000	(32)
Wall to corridor			82.8500	0.0000	0.0000	20.0000	1657.0000	(32)
Party Ceiling 1			45.8800			80.0000	3670.4000	(32b)
Internal Wall 1			223.5600			9.0000	2012.0400	(32c)
Internal Floor 1			45.8800			0.0000	0.0000	(32d)
Internal Ceiling 1			40.4600			9.0000	364.1400	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	11444.3000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		141.0091 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	6.7900	0.0500	0.3395	
E4 Jamb	18.5500	0.0500	0.9275	
E5 Ground floor (normal)	5.9500	0.1600	0.9520	
E18 Party wall between dwellings	6.0700	0.0600	0.3642	
P1 Party wall - Ground floor	19.5500	0.0800	1.5640	
E6 Intermediate floor within a dwelling	5.9500	0.0000	0.0000	
P2 Party wall - Intermediate floor within a dwelling	23.1500	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			4.1472	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	29.6623	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	20.7415	20.5323	20.3232	19.2774	19.0683	18.0226	18.0226	17.8134	18.4408	19.0683	19.4866	19.9049	(38)
Heat transfer coeff	50.4037	50.1946	49.9854	48.9397	48.7306	47.6848	47.6848	47.4757	48.1031	48.7306	49.1488	49.5671	(39)
Average = Sum(39)m / 12 =												48.8874	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6210	0.6185	0.6159	0.6030	0.6004	0.5875	0.5875	0.5850	0.5927	0.6004	0.6056	0.6107	(40)
HLP (average)												0.6024	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4845	(42)
Hot water usage for mixer showers	90.5804	89.2191	87.2355	83.4403	80.6395	77.5160	75.7407	77.7092	79.8672	83.2208	87.0976	90.2333	(42a)
Hot water usage for baths	28.4523	28.0298	27.4347	26.3376	25.5160	24.6051	24.1130	24.7039	25.3473	26.3220	27.4418	28.3562	(42b)
Hot water usage for other uses	40.0738	38.6166	37.1593	35.7021	34.2449	32.7876	32.7876	34.2449	35.7021	37.1593	38.6166	40.0738	(42c)
Average daily hot water use (litres/day)												146.3226	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	159.1065	155.8655	151.8296	145.4800	140.4004	134.9087	132.6413	136.6580	140.9166	146.7022	153.1560	158.6633	(44)
Energy conte	251.9858	221.9504	233.3565	199.1548	189.0059	165.8860	160.4182	169.2112	173.7642	199.0735	218.1987	248.4284	(45)
Energy content (annual)										Total = Sum(45)m =		2430.4335	
Distribution loss (46)m = 0.15 x (45)m	37.7979	33.2926	35.0035	29.8732	28.3509	24.8829	24.0627	25.3817	26.0646	29.8610	32.7298	37.2643	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	272.9666	240.9008	254.3373	219.4588	209.9867	186.1900	181.3990	190.1920	194.0682	220.0543	238.5027	269.4092	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	272.9666	240.9008	254.3373	219.4588	209.9867	186.1900	181.3990	190.1920	194.0682	220.0543	238.5027	269.4092	(64)
										Total per year (kWh/year) = Sum(64)m =		2677.4655	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	100.5699	88.9588	94.3757	82.4622	79.6291	71.4003	70.1237	73.0474	74.0198	82.9766	88.7943	99.3871	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	149.0701	149.0701	149.0701	149.0701	149.0701	149.0701	149.0701	149.0701	149.0701	149.0701	149.0701	149.0701	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.5487	22.6921	18.4545	13.9712	10.4437	8.8170	9.5271	12.3836	16.6213	21.1045	24.6321	26.2588	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	331.1162	334.5521	325.8936	307.4607	284.1925	262.3237	247.7140	244.2780	252.9365	271.3694	294.6376	316.5064	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.3915	52.3915	52.3915	52.3915	52.3915	52.3915	52.3915	52.3915	52.3915	52.3915	52.3915	52.3915	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-99.3801	-99.3801	-99.3801	-99.3801	-99.3801	-99.3801	-99.3801	-99.3801	-99.3801	-99.3801	-99.3801	-99.3801	(71)
Water heating gains (Table 5)	135.1746	132.3792	126.8490	114.5308	107.0284	99.1671	94.2523	98.1819	102.8053	111.5276	123.3254	133.5848	(72)
Total internal gains	593.9211	591.7050	573.2787	538.0443	503.7461	472.3893	453.5749	456.9252	474.4446	506.0831	544.6767	578.4316	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	15.0600	36.7938	0.6300	0.8270	0.7700	200.0688	(79)

Solar gains	200.0688	340.7911	466.2853	577.7501	647.1282	642.4485	619.3889	567.6297	504.8883	376.6468	239.6363	171.2172	(83)
Total gains	793.9898	932.4961	1039.5640	1115.7944	1150.8743	1114.8379	1072.9638	1024.5549	979.3330	882.7299	784.3129	749.6487	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.0702	63.3330	63.5980	64.9569	65.2357	66.6663	66.6663	66.9600	66.0866	65.2357	64.6805	64.1347	
alpha	5.2047	5.2222	5.2399	5.3305	5.3490	5.4444	5.4444	5.4640	5.4058	5.3490	5.3120	5.2756	
util living area	0.8623	0.7738	0.6616	0.5221	0.3921	0.2736	0.1955	0.2131	0.3383	0.5612	0.7783	0.8813	(86)
MIT	20.6288	20.7953	20.9123	20.9770	20.9955	20.9995	20.9999	20.9999	20.9985	20.9728	20.8273	20.5922	(87)
Th 2	20.4111	20.4134	20.4157	20.4273	20.4296	20.4412	20.4412	20.4436	20.4366	20.4296	20.4250	20.4203	(88)
util rest of house	0.8481	0.7554	0.6398	0.4989	0.3685	0.2497	0.1707	0.1874	0.3109	0.5330	0.7572	0.8685	(89)
MIT 2	19.9907	20.1879	20.3230	20.4046	20.4256	20.4409	20.4412	20.4435	20.4354	20.4037	20.2391	19.9552	(90)
Living area fraction									fLA = Living area / (4) =			0.2463	(91)
MIT	20.1479	20.3375	20.4682	20.5456	20.5660	20.5785	20.5788	20.5805	20.5741	20.5438	20.3839	20.1121	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1479	20.3375	20.4682	20.5456	20.5660	20.5785	20.5788	20.5805	20.5741	20.5438	20.3839	20.1121	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8413	0.7529	0.6417	0.5037	0.3742	0.2556	0.1768	0.1937	0.3176	0.5387	0.7557	0.8612	(94)
Useful gains	668.0229	702.0702	667.1328	562.0542	430.6124	284.9565	189.7167	198.4539	310.9902	475.5315	592.6696	645.6071	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	798.7916	774.8793	698.2049	569.9303	432.0445	285.0831	189.7292	198.4743	311.4243	484.5692	652.8902	788.7182	(97)
Space heating kWh	97.2919	48.9277	23.1177	5.6708	1.0655	0.0000	0.0000	0.0000	0.0000	6.7240	43.3588	106.4747	(98a)
Space heating requirement - total per year (kWh/year)												332.6312	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	97.2919	48.9277	23.1177	5.6708	1.0655	0.0000	0.0000	0.0000	0.0000	6.7240	43.3588	106.4747	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												332.6312	
Space heating per m2											(98c) / (4) =	4.0985	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 100.0000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	97.2919	48.9277	23.1177	5.6708	1.0655	0.0000	0.0000	0.0000	0.0000	6.7240	43.3588	106.4747	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	97.2919	48.9277	23.1177	5.6708	1.0655	0.0000	0.0000	0.0000	0.0000	6.7240	43.3588	106.4747	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	272.9666	240.9008	254.3373	219.4588	209.9867	186.1900	181.3990	190.1920	194.0682	220.0543	238.5027	269.4092	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	272.9666	240.9008	254.3373	219.4588	209.9867	186.1900	181.3990	190.1920	194.0682	220.0543	238.5027	269.4092	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	16.7662	15.1437	16.7662	16.2254	16.7662	16.2254	16.7662	16.7662	16.2254	16.7662	16.2254	16.7662	(231)
Lighting	22.3626	17.9401	16.1531	11.8345	9.1413	7.4685	8.3390	10.8393	14.0792	18.4727	20.8648	22.9842	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-19.2630	-30.4477	-49.1997	-61.6461	-72.1613	-69.3579	-68.2544	-61.6915	-50.5112	-37.0475	-22.1317	-16.2507	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.8798	-9.2260	-20.7151	-34.7137	-48.6432	-49.9965	-49.2859	-39.9367	-27.3049	-14.3523	-5.5379	-2.9621	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 332.6312 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 100.0000

Water heating fuel used 2677.4655 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)

mechanical ventilation fans (SFP = 0.7420) 197.4089 (230a)

Total electricity for the above, kWh/year 197.4089 (231)

Electricity for lighting (calculated in Appendix L) 180.4793 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	-864.5168	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2523.4681	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	332.6312	16.4900	54.8509	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2677.4655	16.4900	441.5141	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	197.4089	16.4900	32.5527	(249)
Energy for lighting	180.4793	16.4900	29.7610	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-557.9627	16.4900	-92.0081	
PV Unit electricity exported	-306.5541	5.5900	-17.1364	
Total			-109.1444	(252)
Total energy cost			449.5343	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2828	(257)
SAP value		79.2065	
SAP rating (Section 12)		79	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	332.6312	0.1593	52.9926	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2677.4655	0.1413	378.3630	(264)
Space and water heating			431.3557	(265)
Pumps, fans and electric keep-hot	197.4089	0.1387	27.3831	(267)
Energy for lighting	180.4793	0.1443	26.0487	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-557.9627	0.1324	-73.8800	
PV Unit electricity exported	-306.5541	0.1232	-37.7763	
Total			-111.6563	(269)
Total CO2, kg/year			373.1312	(272)
CO2 emissions per m2			4.6000	(273)
EI value			96.0368	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	35.2800	(1b)	x 2.6700	(2b) =	94.1976	(1b) - (3b)
First floor	45.8800	(1c)	x 2.7000	(2c) =	123.8760	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.1600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		218.0736	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	

Measured/design AP50												3.0000	(17)
Infiltration rate												0.1500	(18)
Number of sides sheltered												3	(19)
Shelter factor								(20) = 1 - [0.075 x (19)] =				0.7750	(20)
Infiltration rate adjusted to include shelter factor								(21) = (18) x (20) =				0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery		
If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.0600	1.2357	18.6103			(27)
Heatloss Floor 1			35.2800	0.1200	4.2336	75.0000	2646.0000	(28a)
External Wall 1	34.1400	15.0600	19.0800	0.1400	2.6712	14.0000	267.1200	(29a)
Total net area of external elements Aum(A, m2)			69.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.5151			(33)
Party Wall 1			41.3800	0.0000	0.0000	20.0000	827.6000	(32)
Wall to corridor			82.8500	0.0000	0.0000	20.0000	1657.0000	(32)
Party Ceiling 1			45.8800			80.0000	3670.4000	(32b)
Internal Wall 1			223.5600			9.0000	2012.0400	(32c)
Internal Floor 1			45.8800			0.0000	0.0000	(32d)
Internal Ceiling 1			40.4600			9.0000	364.1400	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 11444.3000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	141.0091	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	6.7900	0.0500	0.3395
E4 Jamb	18.5500	0.0500	0.9275
E5 Ground floor (normal)	5.9500	0.1600	0.9520
E18 Party wall between dwellings	6.0700	0.0600	0.3642
P1 Party wall - Ground floor	19.5500	0.0800	1.5640
E6 Intermediate floor within a dwelling	5.9500	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.1472	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	29.6623	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	20.9506	20.9506	20.5323	19.2774	19.0683	18.2317	17.8134	17.8134	18.6500	19.6957	20.1140	19.9049	(38)
Heat transfer coeff	50.6129	50.6129	50.1946	48.9397	48.7306	47.8940	47.4757	47.4757	48.3123	49.3580	49.7763	49.5671	(39)
Average = Sum(39)m / 12 =												49.0791	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6236	0.6236	0.6185	0.6030	0.6004	0.5901	0.5850	0.5850	0.5953	0.6082	0.6133	0.6107	(40)
HLP (average)												0.6047	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4845	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	90.5804	89.2191	87.2355	83.4403	80.6395	77.5160	75.7407	77.7092	79.8672	83.2208	87.0976	90.2333	(42a)
Hot water usage for baths	28.4523	28.0298	27.4347	26.3376	25.5160	24.6051	24.1130	24.7039	25.3473	26.3220	27.4418	28.3562	(42b)
Hot water usage for other uses	40.0738	38.6166	37.1593	35.7021	34.2449	32.7876	32.7876	34.2449	35.7021	37.1593	38.6166	40.0738	(42c)
Average daily hot water use (litres/day)												146.3226	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	159.1065	155.8655	151.8296	145.4800	140.4004	134.9087	132.6413	136.6580	140.9166	146.7022	153.1560	158.6633	(44)
Energy conte	251.9858	221.9504	233.3565	199.1548	189.0059	165.8860	160.4182	169.2112	173.7642	199.0735	218.1987	248.4284	(45)
Energy content (annual)										Total = Sum(45)m =		2430.4335	
Distribution loss (46)m = 0.15 x (45)m	37.7979	33.2926	35.0035	29.8732	28.3509	24.8829	24.0627	25.3817	26.0646	29.8610	32.7298	37.2643	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	272.9666	240.9008	254.3373	219.4588	209.9867	186.1900	181.3990	190.1920	194.0682	220.0543	238.5027	269.4092	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	272.9666	240.9008	254.3373	219.4588	209.9867	186.1900	181.3990	190.1920	194.0682	220.0543	238.5027	269.4092	(64)
										Total per year (kWh/year) = Sum(64)m =		2677.4655	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

	100.5699	88.9588	94.3757	82.4622	79.6291	71.4003	70.1237	73.0474	74.0198	82.9766	88.7943	99.3871 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	149.0701	149.0701	149.0701	149.0701	149.0701	149.0701	149.0701	149.0701	149.0701	149.0701	149.0701	149.0701	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	25.5487	22.6921	18.4545	13.9712	10.4437	8.8170	9.5271	12.3836	16.6213	21.1045	24.6321	26.2588 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	331.1162	334.5521	325.8936	307.4607	284.1925	262.3237	247.7140	244.2780	252.9365	271.3694	294.6376	316.5064 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	52.3915	52.3915	52.3915	52.3915	52.3915	52.3915	52.3915	52.3915	52.3915	52.3915	52.3915	52.3915 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-99.3801	-99.3801	-99.3801	-99.3801	-99.3801	-99.3801	-99.3801	-99.3801	-99.3801	-99.3801	-99.3801	-99.3801 (71)

Water heating gains (Table 5)

	135.1746	132.3792	126.8490	114.5308	107.0284	99.1671	94.2523	98.1819	102.8053	111.5276	123.3254	133.5848 (72)

Total internal gains

	593.9211	591.7050	573.2787	538.0443	503.7461	472.3893	453.5749	456.9252	474.4446	506.0831	544.6767	578.4316 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	15.0600	33.4622	0.6300	0.8270	0.7700	181.9530	(79)

Solar gains	181.9530	330.7933	473.0137	616.4994	683.5392	659.5320	643.7543	573.6946	507.5872	363.4062	223.9737	159.2423	(83)
Total gains	775.8740	922.4983	1046.2924	1154.5437	1187.2853	1131.9214	1097.3292	1030.6198	982.0318	869.4894	768.6504	737.6738	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.8096	62.8096	63.3330	64.9569	65.2357	66.3752	66.9600	66.9600	65.8005	64.4064	63.8652	64.1347	
alpha	5.1873	5.1873	5.2222	5.3305	5.3490	5.4250	5.4640	5.4640	5.3867	5.2938	5.2577	5.2756	
util living area	0.8805	0.7996	0.6920	0.5443	0.4203	0.3295	0.2638	0.2854	0.4016	0.6181	0.8095	0.8967	(86)
MIT	20.5696	20.7460	20.8841	20.9698	20.9931	20.9985	20.9996	20.9995	20.9958	20.9518	20.7759	20.5352	(87)
Th 2	20.4088	20.4088	20.4134	20.4273	20.4296	20.4389	20.4436	20.4436	20.4343	20.4227	20.4180	20.4203	(88)
util rest of house	0.8678	0.7825	0.6714	0.5223	0.3976	0.3059	0.2398	0.2598	0.3744	0.5907	0.7901	0.8853	(89)
MIT 2	19.9172	20.1258	20.2889	20.3967	20.4232	20.4377	20.4433	20.4432	20.4306	20.3750	20.1734	19.8858	(90)

Living area fraction fLA = Living area / (4) = 0.2463 (91)

MIT	20.0779	20.2785	20.4355	20.5379	20.5636	20.5758	20.5803	20.5802	20.5698	20.5171	20.3218	20.0457	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0779	20.2785	20.4355	20.5379	20.5636	20.5758	20.5803	20.5802	20.5698	20.5171	20.3218	20.0457	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8601	0.7786	0.6722	0.5266	0.4029	0.3117	0.2457	0.2661	0.3809	0.5952	0.7868	0.8773	(94)
Useful gains	667.3152	718.2716	703.3310	607.9832	478.3805	352.8193	269.5824	274.2723	374.0708	517.5625	604.7525	647.1706	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	818.8092	808.7198	744.6604	618.4933	480.6565	353.2581	269.6775	274.4181	375.3783	533.9103	683.0210	810.2119	(97)
Space heating kWh	112.7115	60.7812	30.7490	7.5673	1.6934	0.0000	0.0000	0.0000	0.0000	12.1628	56.3533	121.3027	(98a)

Space heating requirement - total per year (kWh/year) 403.3211

Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)

Solar heating contribution - total per year (kWh/year) 0.0000

Space heating kWh	112.7115	60.7812	30.7490	7.5673	1.6934	0.0000	0.0000	0.0000	0.0000	12.1628	56.3533	121.3027	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 403.3211

Space heating per m2 (98c) / (4) = 4.9695 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 100.0000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	112.7115	60.7812	30.7490	7.5673	1.6934	0.0000	0.0000	0.0000	0.0000	12.1628	56.3533	121.3027	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	112.7115	60.7812	30.7490	7.5673	1.6934	0.0000	0.0000	0.0000	0.0000	12.1628	56.3533	121.3027	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating
Water heating requirement

	272.9666	240.9008	254.3373	219.4588	209.9867	186.1900	181.3990	190.1920	194.0682	220.0543	238.5027	269.4092 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	272.9666	240.9008	254.3373	219.4588	209.9867	186.1900	181.3990	190.1920	194.0682	220.0543	238.5027	269.4092 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	16.7662	15.1437	16.7662	16.2254	16.7662	16.2254	16.7662	16.7662	16.2254	16.7662	16.2254	16.7662 (231)
Lighting	22.3626	17.9401	16.1531	11.8345	9.1413	7.4685	8.3390	10.8393	14.0792	18.4727	20.8648	22.9842 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-17.4728	-29.3620	-49.3029	-64.2799	-74.6935	-70.3508	-69.8107	-61.7100	-50.1818	-35.5652	-20.6207	-15.0352 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-3.2692	-8.5632	-20.5879	-37.3510	-51.8638	-51.3793	-51.4685	-39.9591	-26.9840	-13.2742	-4.8583	-2.5804 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year

Space heating fuel - main system 1	403.3211 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2677.4655 (219)
Space cooling fuel	0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)

mechanical ventilation fans (SFP = 0.7420)	197.4089 (230a)
Total electricity for the above, kWh/year	197.4089 (231)
Electricity for lighting (calculated in Appendix L)	180.4793 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	-870.5246 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2588.1503 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	403.3211	25.1600	101.4756	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2677.4655	25.1600	673.6503	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	197.4089	25.1600	49.6681	(249)
Energy for lighting	180.4793	25.1600	45.4086	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-558.3857	25.1600	-140.4898	
PV Unit electricity exported	-312.1389	5.8100	-18.1353	
Total			-158.6251	(252)
Total energy cost			711.5775	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	403.3211	0.1588	64.0430	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2677.4655	0.1413	378.3630	(264)
Space and water heating			442.4061	(265)
Pumps, fans and electric keep-hot	197.4089	0.1387	27.3831	(267)
Energy for lighting	180.4793	0.1443	26.0487	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-558.3857	0.1321	-73.7670	
PV Unit electricity exported	-312.1389	0.1227	-38.3028	
Total			-112.0698	(269)
Total CO2, kg/year			383.7681	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	403.3211	1.5877	640.3595	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2677.4655	1.5225	4076.5701	(278)
Space and water heating			4716.9296	(279)
Pumps, fans and electric keep-hot	197.4089	1.5128	298.6403	(281)
Energy for lighting	180.4793	1.5338	276.8251	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-558.3857	1.4881	-830.9417	
PV Unit electricity exported	-312.1389	0.4503	-140.5691	
Total			-971.5108	(283)
Total Primary energy kWh/year			4320.8842	(286)

SAP 10 EPC IMPROVEMENTS

Unit 382 TH_Copy

Current energy efficiency rating: C 79
Current environmental impact rating: A 96

N Solar water heating	Not applicable
U Solar photovoltaic panels	Not applicable
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 79
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£870	£870	£0
Space heating	£151	£151	£0
Water heating	£674	£674	£0
Lighting	£45	£45	£0
Generated (PV)	-£159	-£159	£0
Total cost of fuels	£711	£711	£0
Total cost of uses	£711	£711	£0
Delivered energy	32 kWh/m²	32 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	53 kWh/m²	53 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	35.2800 (1b)	x	2.6700 (2b)	=	94.1976	(1b) - (3b)
First floor	45.8800 (1c)	x	2.7000 (2c)	=	123.8760	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.1600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	218.0736	(5)

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2. Ventilation rate
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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.0600	1.2357	18.6103			(27)
Heatloss Floor 1			35.2800	0.1200	4.2336	75.0000	2646.0000	(28a)
External Wall 1	34.1400	15.0600	19.0800	0.1400	2.6712	14.0000	267.1200	(29a)
Total net area of external elements Aum(A, m2)			69.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.5151			(33)
Party Wall 1			41.3800	0.0000	0.0000	20.0000	827.6000	(32)
Wall to corridor			82.8500	0.0000	0.0000	20.0000	1657.0000	(32)
Party Ceiling 1			45.8800			80.0000	3670.4000	(32b)
Internal Wall 1			223.5600			9.0000	2012.0400	(32c)
Internal Floor 1			45.8800			0.0000	0.0000	(32d)
Internal Ceiling 1			40.4600			9.0000	364.1400	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 11444.3000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 141.0091 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	6.7900	0.0500	0.3395
E4 Jamb	18.5500	0.0500	0.9275
E5 Ground floor (normal)	5.9500	0.1600	0.9520
E18 Party wall between dwellings	6.0700	0.0600	0.3642
P1 Party wall - Ground floor	19.5500	0.0800	1.5640
E6 Intermediate floor within a dwelling	5.9500	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.1472 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 29.6623 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	20.7415	20.5323	20.3232	19.2774	19.0683	18.0226	18.0226	17.8134	18.4408	19.0683	19.4866	19.9049	(38)
Heat transfer coeff	50.4037	50.1946	49.9854	48.9397	48.7306	47.6848	47.6848	47.4757	48.1031	48.7306	49.1488	49.5671	(39)

Average = Sum(39)m / 12 = 48.8874

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6210	0.6185	0.6159	0.6030	0.6004	0.5875	0.5875	0.5850	0.5927	0.6004	0.6056	0.6107	(40)
HLP (average)												0.6024	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.4845 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	90.5804	89.2191	87.2355	83.4403	80.6395	77.5160	75.7407	77.7092	79.8672	83.2208	87.0976	90.2333	(42a)
Hot water usage for baths	28.4523	28.0298	27.4347	26.3376	25.5160	24.6051	24.1130	24.7039	25.3473	26.3220	27.4418	28.3562	(42b)
Hot water usage for other uses	40.0738	38.6166	37.1593	35.7021	34.2449	32.7876	32.7876	34.2449	35.7021	37.1593	38.6166	40.0738	(42c)

Average daily hot water use (litres/day) 146.3226 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	159.1065	155.8655	151.8296	145.4800	140.4004	134.9087	132.6413	136.6580	140.9166	146.7022	153.1560	158.6633	(44)
Energy conte	251.9858	221.9504	233.3565	199.1548	189.0059	165.8860	160.4182	169.2112	173.7642	199.0735	218.1987	248.4284	(45)

Energy content (annual) Total = Sum(45)m = 2430.4335

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Distribution loss (46)m = 0.15 x (45)m	37.7979	33.2926	35.0035	29.8732	28.3509	24.8829	24.0627	25.3817	26.0646	29.8610	32.7298	37.2643	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	272.9666	240.9008	254.3373	219.4588	209.9867	186.1900	181.3990	190.1920	194.0682	220.0543	238.5027	269.4092	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	272.9666	240.9008	254.3373	219.4588	209.9867	186.1900	181.3990	190.1920	194.0682	220.0543	238.5027	269.4092	(64)

Total per year (kWh/year) = Sum(64)m = 2677.4655 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	100.5699	88.9588	94.3757	82.4622	79.6291	71.4003	70.1237	73.0474	74.0198	82.9766	88.7943	99.3871	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	149.0701	149.0701	149.0701	149.0701	149.0701	149.0701	149.0701	149.0701	149.0701	149.0701	149.0701	149.0701	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.5487	22.6921	18.4545	13.9712	10.4437	8.8170	9.5271	12.3836	16.6213	21.1045	24.6321	26.2588	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	331.1162	334.5521	325.8936	307.4607	284.1925	262.3237	247.7140	244.2780	252.9365	271.3694	294.6376	316.5064	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.3915	52.3915	52.3915	52.3915	52.3915	52.3915	52.3915	52.3915	52.3915	52.3915	52.3915	52.3915	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-99.3801	-99.3801	-99.3801	-99.3801	-99.3801	-99.3801	-99.3801	-99.3801	-99.3801	-99.3801	-99.3801	-99.3801	(71)
Water heating gains (Table 5)													
	135.1746	132.3792	126.8490	114.5308	107.0284	99.1671	94.2523	98.1819	102.8053	111.5276	123.3254	133.5848	(72)
Total internal gains													
	593.9211	591.7050	573.2787	538.0443	503.7461	472.3893	453.5749	456.9252	474.4446	506.0831	544.6767	578.4316	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	15.0600	36.7938	0.6300	0.8270	0.7700	200.0688	(79)

Solar gains	200.0688	340.7911	466.2853	577.7501	647.1282	642.4485	619.3889	567.6297	504.8883	376.6468	239.6363	171.2172	(83)
Total gains	793.9898	932.4961	1039.5640	1115.7944	1150.8743	1114.8379	1072.9638	1024.5549	979.3330	882.7299	784.3129	749.6487	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.0702	63.3330	63.5980	64.9569	65.2357	66.6663	66.6663	66.9600	66.0866	65.2357	64.6805	64.1347	
alpha	5.2047	5.2222	5.2399	5.3305	5.3490	5.4444	5.4444	5.4640	5.4058	5.3490	5.3120	5.2756	
util living area													
	0.8623	0.7738	0.6616	0.5221	0.3921	0.2736	0.1955	0.2131	0.3383	0.5612	0.7783	0.8813	(86)
MIT	20.6288	20.7953	20.9123	20.9770	20.9955	20.9995	20.9999	20.9999	20.9985	20.9728	20.8273	20.5922	(87)
Th 2	20.4111	20.4134	20.4157	20.4273	20.4296	20.4412	20.4412	20.4436	20.4366	20.4296	20.4250	20.4203	(88)
util rest of house													
	0.8481	0.7554	0.6398	0.4989	0.3685	0.2497	0.1707	0.1874	0.3109	0.5330	0.7572	0.8685	(89)
MIT 2	19.9907	20.1879	20.3230	20.4046	20.4256	20.4409	20.4412	20.4435	20.4354	20.4037	20.2391	19.9552	(90)
Living area fraction										fLA = Living area / (4) =		0.2463	(91)
MIT	20.1479	20.3375	20.4682	20.5456	20.5660	20.5785	20.5788	20.5805	20.5741	20.5438	20.3839	20.1121	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1479	20.3375	20.4682	20.5456	20.5660	20.5785	20.5788	20.5805	20.5741	20.5438	20.3839	20.1121	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8413	0.7529	0.6417	0.5037	0.3742	0.2556	0.1768	0.1937	0.3176	0.5387	0.7557	0.8612	(94)
Useful gains	668.0229	702.0702	667.1328	562.0542	430.6124	284.9565	189.7167	198.4539	310.9902	475.5315	592.6696	645.6071	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	798.7916	774.8793	698.2049	569.9303	432.0445	285.0831	189.7292	198.4743	311.4243	484.5692	652.8902	788.7182	(97)
Space heating kWh													
	97.2919	48.9277	23.1177	5.6708	1.0655	0.0000	0.0000	0.0000	0.0000	6.7240	43.3588	106.4747	(98a)
Space heating requirement - total per year (kWh/year)												332.6312	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	97.2919	48.9277	23.1177	5.6708	1.0655	0.0000	0.0000	0.0000	0.0000	6.7240	43.3588	106.4747	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												332.6312	
Space heating per m2											(98c) / (4) =	4.0985	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	97.2919	48.9277	23.1177	5.6708	1.0655	0.0000	0.0000	0.0000	0.0000	6.7240	43.3588	106.4747	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	97.2919	48.9277	23.1177	5.6708	1.0655	0.0000	0.0000	0.0000	0.0000	6.7240	43.3588	106.4747	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	272.9666	240.9008	254.3373	219.4588	209.9867	186.1900	181.3990	190.1920	194.0682	220.0543	238.5027	269.4092	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	272.9666	240.9008	254.3373	219.4588	209.9867	186.1900	181.3990	190.1920	194.0682	220.0543	238.5027	269.4092	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	16.7662	15.1437	16.7662	16.2254	16.7662	16.2254	16.7662	16.7662	16.2254	16.7662	16.2254	16.7662	(231)
Lighting	22.3626	17.9401	16.1531	11.8345	9.1413	7.4685	8.3390	10.8393	14.0792	18.4727	20.8648	22.9842	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-19.2630	-30.4477	-49.1997	-61.6461	-72.1613	-69.3579	-68.2544	-61.6915	-50.5112	-37.0475	-22.1317	-16.2507	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													

(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.8798	-9.2260	-20.7151	-34.7137	-48.6432	-49.9965	-49.2859	-39.9367	-27.3049	-14.3523	-5.5379	-2.9621	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	332.6312	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2677.4655	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	197.4089	(230a)
Total electricity for the above, kWh/year	197.4089	(231)
Electricity for lighting (calculated in Appendix L)	180.4793	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-864.5168	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2523.4681	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	332.6312	16.4900	54.8509	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2677.4655	16.4900	441.5141	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	197.4089	16.4900	32.5527	(249)
Energy for lighting	180.4793	16.4900	29.7610	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-557.9627	16.4900	-92.0081	
PV Unit electricity exported	-306.5541	5.5900	-17.1364	
Total			-109.1444	(252)
Total energy cost			449.5343	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2828	(257)
SAP value	79.2065	
SAP rating (Section 12)	79	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	332.6312	0.1593	52.9926	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2677.4655	0.1413	378.3630	(264)
Space and water heating			431.3557	(265)
Pumps, fans and electric keep-hot	197.4089	0.1387	27.3831	(267)
Energy for lighting	180.4793	0.1443	26.0487	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-557.9627	0.1324	-73.8800	
PV Unit electricity exported	-306.5541	0.1232	-37.7763	
Total			-111.6563	(269)
Total CO2, kg/year			373.1312	(272)
CO2 emissions per m2			4.6000	(273)
EI value			96.0368	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area	Storey height	Volume

	(m2)		(m)		(m3)	
Ground floor	35.2800 (1b)	x	2.6700 (2b)	=	94.1976	(1b) - (3b)
First floor	45.8800 (1c)	x	2.7000 (2c)	=	123.8760	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.1600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	218.0736	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.0600	1.2357	18.6103			(27)
Heatloss Floor 1			35.2800	0.1200	4.2336	75.0000	2646.0000	(28a)
External Wall 1	34.1400	15.0600	19.0800	0.1400	2.6712	14.0000	267.1200	(29a)
Total net area of external elements Aum(A, m2)			69.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.5151			(33)
Party Wall 1			41.3800	0.0000	0.0000	20.0000	827.6000	(32)
Wall to corridor			82.8500	0.0000	0.0000	20.0000	1657.0000	(32)
Party Ceiling 1			45.8800			80.0000	3670.4000	(32b)
Internal Wall 1			223.5600			9.0000	2012.0400	(32c)
Internal Floor 1			45.8800			0.0000	0.0000	(32d)
Internal Ceiling 1			40.4600			9.0000	364.1400	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 11444.3000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	141.0091 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	6.7900	0.0500	0.3395
E4 Jamb	18.5500	0.0500	0.9275
E5 Ground floor (normal)	5.9500	0.1600	0.9520
E18 Party wall between dwellings	6.0700	0.0600	0.3642
P1 Party wall - Ground floor	19.5500	0.0800	1.5640
E6 Intermediate floor within a dwelling	5.9500	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.1472 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	29.6623 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	20.9506	20.9506	20.5323	19.2774	19.0683	18.2317	17.8134	17.8134	18.6500	19.6957	20.1140	19.9049	(38)
Heat transfer coeff	50.6129	50.6129	50.1946	48.9397	48.7306	47.8940	47.4757	47.4757	48.3123	49.3580	49.7763	49.5671	(39)
Average = Sum(39)m / 12 =												49.0791	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6236	0.6236	0.6185	0.6030	0.6004	0.5901	0.5850	0.5850	0.5953	0.6082	0.6133	0.6107	(40)
HLP (average)												0.6047	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4845 (42)

Hot water usage for mixer showers	90.5804	89.2191	87.2355	83.4403	80.6395	77.5160	75.7407	77.7092	79.8672	83.2208	87.0976	90.2333 (42a)
Hot water usage for baths	28.4523	28.0298	27.4347	26.3376	25.5160	24.6051	24.1130	24.7039	25.3473	26.3220	27.4418	28.3562 (42b)
Hot water usage for other uses	40.0738	38.6166	37.1593	35.7021	34.2449	32.7876	32.7876	34.2449	35.7021	37.1593	38.6166	40.0738 (42c)
Average daily hot water use (litres/day)												146.3226 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

	159.1065	155.8655	151.8296	145.4800	140.4004	134.9087	132.6413	136.6580	140.9166	146.7022	153.1560	158.6633	(44)
Energy conte	251.9858	221.9504	233.3565	199.1548	189.0059	165.8860	160.4182	169.2112	173.7642	199.0735	218.1987	248.4284	(45)
Energy content (annual)										Total = Sum(45)m =		2430.4335	
Distribution loss (46)m = 0.15 x (45)m													
	37.7979	33.2926	35.0035	29.8732	28.3509	24.8829	24.0627	25.3817	26.0646	29.8610	32.7298	37.2643	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	272.9666	240.9008	254.3373	219.4588	209.9867	186.1900	181.3990	190.1920	194.0682	220.0543	238.5027	269.4092	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	272.9666	240.9008	254.3373	219.4588	209.9867	186.1900	181.3990	190.1920	194.0682	220.0543	238.5027	269.4092	(64)
										Total per year (kWh/year) = Sum(64)m =		2677.4655	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	100.5699	88.9588	94.3757	82.4622	79.6291	71.4003	70.1237	73.0474	74.0198	82.9766	88.7943	99.3871	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	149.0701	149.0701	149.0701	149.0701	149.0701	149.0701	149.0701	149.0701	149.0701	149.0701	149.0701	149.0701	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.5487	22.6921	18.4545	13.9712	10.4437	8.8170	9.5271	12.3836	16.6213	21.1045	24.6321	26.2588	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	331.1162	334.5521	325.8936	307.4607	284.1925	262.3237	247.7140	244.2780	252.9365	271.3694	294.6376	316.5064	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.3915	52.3915	52.3915	52.3915	52.3915	52.3915	52.3915	52.3915	52.3915	52.3915	52.3915	52.3915	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-99.3801	-99.3801	-99.3801	-99.3801	-99.3801	-99.3801	-99.3801	-99.3801	-99.3801	-99.3801	-99.3801	-99.3801	(71)
Water heating gains (Table 5)													
	135.1746	132.3792	126.8490	114.5308	107.0284	99.1671	94.2523	98.1819	102.8053	111.5276	123.3254	133.5848	(72)
Total internal gains													
	593.9211	591.7050	573.2787	538.0443	503.7461	472.3893	453.5749	456.9252	474.4446	506.0831	544.6767	578.4316	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	15.0600	33.4622	0.6300	0.8270	0.7700	181.9530	(79)

Solar gains	181.9530	330.7933	473.0137	616.4994	683.5392	659.5320	643.7543	573.6946	507.5872	363.4062	223.9737	159.2423	(83)
Total gains	775.8740	922.4983	1046.2924	1154.5437	1187.2853	1131.9214	1097.3292	1030.6198	982.0318	869.4894	768.6504	737.6738	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.8096	62.8096	63.3330	64.9569	65.2357	66.3752	66.9600	66.9600	65.8005	64.4064	63.8652	64.1347	
alpha	5.1873	5.1873	5.2222	5.3305	5.3490	5.4250	5.4640	5.4640	5.3867	5.2938	5.2577	5.2756	
util living area													
	0.8805	0.7996	0.6920	0.5443	0.4203	0.3295	0.2638	0.2854	0.4016	0.6181	0.8095	0.8967	(86)
MIT	20.5696	20.7460	20.8841	20.9698	20.9931	20.9985	20.9996	20.9995	20.9958	20.9518	20.7759	20.5352	(87)
Th 2	20.4088	20.4088	20.4134	20.4273	20.4296	20.4389	20.4436	20.4436	20.4343	20.4227	20.4180	20.4203	(88)
util rest of house													
	0.8678	0.7825	0.6714	0.5223	0.3976	0.3059	0.2398	0.2598	0.3744	0.5907	0.7901	0.8853	(89)
MIT 2	19.9172	20.1258	20.2889	20.3967	20.4232	20.4377	20.4433	20.4432	20.4306	20.3750	20.1734	19.8858	(90)
Living area fraction										fLA = Living area / (4) =		0.2463	(91)
MIT	20.0779	20.2785	20.4355	20.5379	20.5636	20.5758	20.5803	20.5802	20.5698	20.5171	20.3218	20.0457	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0779	20.2785	20.4355	20.5379	20.5636	20.5758	20.5803	20.5802	20.5698	20.5171	20.3218	20.0457	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8601	0.7786	0.6722	0.5266	0.4029	0.3117	0.2457	0.2661	0.3809	0.5952	0.7868	0.8773	(94)
Useful gains	667.3152	718.2716	703.3310	607.9832	478.3805	352.8193	269.5824	274.2723	374.0708	517.5625	604.7525	647.1706	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	818.8092	808.7198	744.6604	618.4933	480.6565	353.2581	269.6775	274.4181	375.3783	533.9103	683.0210	810.2119	(97)
Space heating kWh													
	112.7115	60.7812	30.7490	7.5673	1.6934	0.0000	0.0000	0.0000	0.0000	12.1628	56.3533	121.3027	(98a)
Space heating requirement - total per year (kWh/year)												403.3211	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	112.7115	60.7812	30.7490	7.5673	1.6934	0.0000	0.0000	0.0000	0.0000	12.1628	56.3533	121.3027	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 403.3211
Space heating per m2 (98c) / (4) = 4.9695 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 100.0000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	112.7115	60.7812	30.7490	7.5673	1.6934	0.0000	0.0000	0.0000	0.0000	12.1628	56.3533	121.3027	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	112.7115	60.7812	30.7490	7.5673	1.6934	0.0000	0.0000	0.0000	0.0000	12.1628	56.3533	121.3027	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	272.9666	240.9008	254.3373	219.4588	209.9867	186.1900	181.3990	190.1920	194.0682	220.0543	238.5027	269.4092	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	272.9666	240.9008	254.3373	219.4588	209.9867	186.1900	181.3990	190.1920	194.0682	220.0543	238.5027	269.4092	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	16.7662	15.1437	16.7662	16.2254	16.7662	16.2254	16.7662	16.7662	16.2254	16.7662	16.2254	16.7662	(231)
Lighting	22.3626	17.9401	16.1531	11.8345	9.1413	7.4685	8.3390	10.8393	14.0792	18.4727	20.8648	22.9842	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-17.4728	-29.3620	-49.3029	-64.2799	-74.6935	-70.3508	-69.8107	-61.7100	-50.1818	-35.5652	-20.6207	-15.0352	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.2692	-8.5632	-20.5879	-37.3510	-51.8638	-51.3793	-51.4685	-39.9591	-26.9840	-13.2742	-4.8583	-2.5804	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year
Space heating fuel - main system 1 403.3211 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 100.0000
Water heating fuel used 2677.4655 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)
mechanical ventilation fans (SFP = 0.7420) 197.4089 (230a)
Total electricity for the above, kWh/year 197.4089 (231)
Electricity for lighting (calculated in Appendix L) 180.4793 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation -870.5246 (233)
Wind generation 0.0000 (234)
Hydro-electric generation (Appendix N) 0.0000 (235a)
Electricity generated - Micro CHP (Appendix N) 0.0000 (235)
Appendix Q - special features
Energy saved or generated -0.0000 (236)
Energy used 0.0000 (237)
Total delivered energy for all uses 2588.1503 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	403.3211	25.1600	101.4756	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2677.4655	25.1600	673.6503	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	197.4089	25.1600	49.6681	(249)
Energy for lighting	180.4793	25.1600	45.4086	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-558.3857	25.1600	-140.4898	
PV Unit electricity exported	-312.1389	5.8100	-18.1353	
Total			-158.6251	(252)
Total energy cost			711.5775	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	403.3211	0.1588	64.0430	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2677.4655	0.1413	378.3630	(264)
Space and water heating			442.4061	(265)

Pumps, fans and electric keep-hot	197.4089	0.1387	27.3831	(267)
Energy for lighting	180.4793	0.1443	26.0487	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-558.3857	0.1321	-73.7670	
PV Unit electricity exported	-312.1389	0.1227	-38.3028	
Total			-112.0698	(269)
Total CO2, kg/year			383.7681	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	403.3211	1.5877	640.3595	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2677.4655	1.5225	4076.5701	(278)
Space and water heating			4716.9296	(279)
Pumps, fans and electric keep-hot	197.4089	1.5128	298.6403	(281)
Energy for lighting	180.4793	1.5338	276.8251	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-558.3857	1.4881	-830.9417	
PV Unit electricity exported	-312.1389	0.4503	-140.5691	
Total			-971.5108	(283)
Total Primary energy kWh/year			4320.8842	(286)

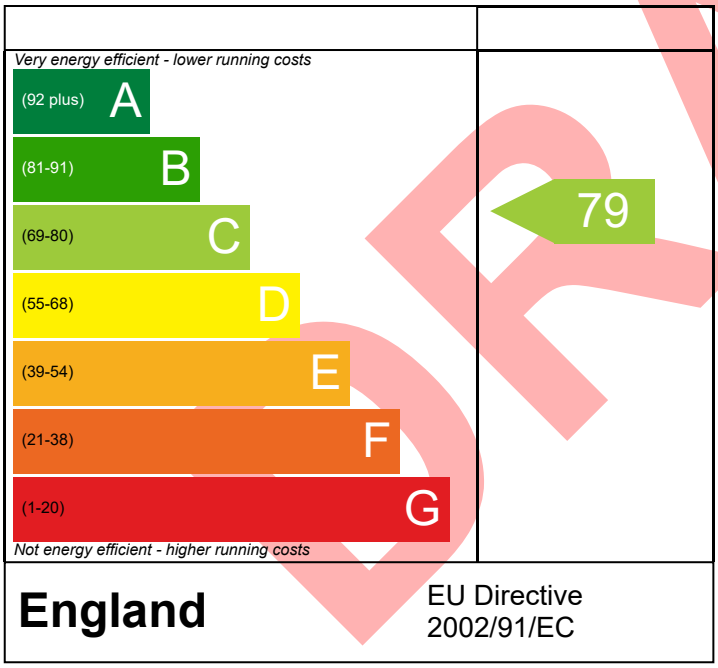
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	81.16 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

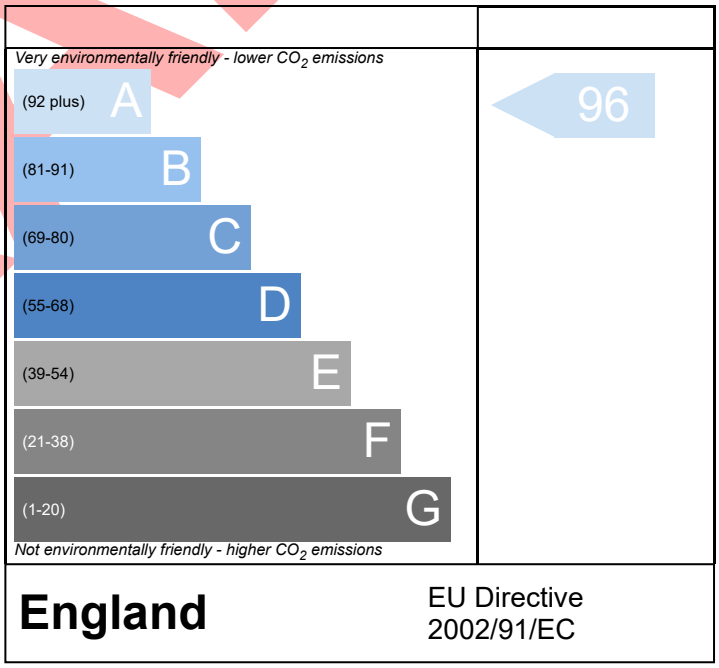
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:11

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	92 m^2
Site Reference	Unit 383 TH GF_Copy	Plot Reference	Unit 383 TH_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*9.89 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	4.3 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*53.17 kWh$_{PE}$/m^2*	
Dwelling primary energy	48.75 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*21.8 kWh/m^2*	
Dwelling fabric energy efficiency	20.1 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.12	Heatloss Floor 1 (0.12)	OK
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	18.39	0.14 **(!)**
Party wall: Party Wall (1)	93.42	0 **(!)**
Party wall: Party Wall (2)	36.14	0 **(!)**
Ground floor: Heatloss Floor 1, Heatloss Floor 1	40.46	0.12

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	15.75	South West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.16	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.08	
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0 **(!)**	
Party wall	P2: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	1.19 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 383 TH GF_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 383 TH_Copy	**Prop Type Ref**	Unit 383 TH GF
Property			

SAP Rating	80 C	**DER**	4.30	**TER**	9.89
Environmental	96 A	**% DER < TER**			56.52
CO_2 Emissions (t/year)	0.4	**DFEE**	20.09	**TFEE**	21.76
Compliance Check	See BREL	**% DFEE < TFEE**			7.69
% DPER < TPER	8.32	**DPER**	48.75	**TPER**	53.17

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.4600 (1b)	x	2.6700 (2b)	=	108.0282	(1b) - (3b)
First floor	51.1700 (1c)	x	2.7000 (2c)	=	138.1590	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.1872	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.7500	1.2357	19.4629			(27)
Heatloss Floor 1			40.4600	0.1200	4.8552	75.0000	3034.5000	(28a)
External Wall 1	34.1400	15.7500	18.3900	0.1400	2.5746	14.0000	257.4600	(29a)
Total net area of external elements Aum(A, m2)			74.6000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.8927			(33)
Party Wall 1			93.4200	0.0000	0.0000	20.0000	1868.4000	(32)
Wall to corridor			36.1400	0.0000	0.0000	20.0000	722.8000	(32)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			223.5600			9.0000	2012.0400	(32c)
Internal Floor 1			51.1700			0.0000	0.0000	(32d)
Internal Ceiling 1			40.4600			9.0000	364.1400	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12352.9400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		134.8133 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	6.7900	0.0500	0.3395
E4 Jamb	18.5500	0.0500	0.9275
E5 Ground floor (normal)	5.9500	0.1600	0.9520
E18 Party wall between dwellings	6.0700	0.0600	0.3642
P1 Party wall - Ground floor	19.5500	0.0800	1.5640
E6 Intermediate floor within a dwelling	5.9500	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.1472 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 31.0399 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.4154	23.1793	22.9432	21.7626	21.5265	20.3460	20.3460	20.1099	20.8182	21.5265	21.9987	22.4710	(38)
Heat transfer coeff	54.4553	54.2192	53.9831	52.8026	52.5665	51.3859	51.3859	51.1498	51.8581	52.5665	53.0387	53.5109	(39)

Average = Sum(39)m / 12 = 52.7435

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5943	0.5917	0.5891	0.5763	0.5737	0.5608	0.5608	0.5582	0.5660	0.5737	0.5788	0.5840	(40)
HLP (average)												0.5756	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6474 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	94.3355	92.9178	90.8520	86.8994	83.9824	80.7295	78.8805	80.9307	83.1782	86.6708	90.7083	93.9740	(42a)
Hot water usage for baths	29.6267	29.1867	28.5671	27.4247	26.5692	25.6207	25.1083	25.7236	26.3935	27.4085	28.5745	29.5266	(42b)
Hot water usage for other uses	41.7418	40.2239	38.7061	37.1882	35.6703	34.1524	34.1524	35.6703	37.1882	38.7061	40.2239	41.7418	(42c)

Average daily hot water use (litres/day) 152.3899 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	165.7040	162.3285	158.1251	151.5122	146.2220	140.5026	138.1413	142.3246	146.7598	152.7854	159.5067	165.2424	(44)
Energy conte	262.4347	231.1536	243.0325	207.4126	196.8429	172.7643	167.0699	176.2276	180.9695	207.3283	227.2466	258.7297	(45)

Energy content (annual) Total = Sum(45)m = 2531.2122

Distribution loss (46)m = 0.15 x (45)m	39.3652	34.6730	36.4549	31.1119	29.5264	25.9146	25.0605	26.4341	27.1454	31.0992	34.0870	38.8095	(46)

Water storage loss:

Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(64)

Total per year (kWh/year) = Sum(64)m = 2778.2442 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	104.0442	92.0189	97.5929	85.2079	82.2349	73.6873	72.3354	75.3803	76.4156	85.7213	91.8027	102.8123	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.0156	24.8832	20.2364	15.3202	11.4521	9.6683	10.4469	13.5793	18.2262	23.1423	27.0105	28.7942	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	361.2608	365.0096	355.5628	335.4518	310.0653	286.2055	270.2657	266.5170	275.9637	296.0747	321.4613	345.3210	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	(71)
Water heating gains (Table 5)	139.8443	136.9329	131.1733	118.3443	110.5308	102.3435	97.2250	101.3176	106.1327	115.2168	127.5037	138.1885	(72)
Total internal gains	635.6000	633.3049	613.4517	575.5956	538.5274	504.6966	484.4169	487.8932	506.8019	540.9131	582.4547	618.7830	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	15.7500	36.7938	0.6300	0.8270	0.7700	209.2353	(79)

Solar gains	209.2353	356.4051	487.6489	604.2207	676.7775	671.8834	647.7673	593.6367	528.0207	393.9035	250.6156	179.0618	(83)
Total gains	844.8352	989.7099	1101.1007	1179.8163	1215.3049	1176.5800	1132.1842	1081.5299	1034.8226	934.8166	833.0703	797.8448	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.0126	63.2870	63.5638	64.9849	65.2768	66.7765	66.7765	67.0848	66.1684	65.2768	64.6957	64.1247	
alpha	5.2008	5.2191	5.2376	5.3323	5.3518	5.4518	5.4518	5.4723	5.4112	5.3518	5.3130	5.2750	
util living area	0.8680	0.7823	0.6718	0.5319	0.4004	0.2793	0.1997	0.2175	0.3451	0.5706	0.7861	0.8863	(86)
MIT	20.6145	20.7838	20.9057	20.9750	20.9951	20.9995	20.9999	20.9999	20.9983	20.9707	20.8187	20.5786	(87)
Th 2	20.4351	20.4375	20.4398	20.4514	20.4537	20.4654	20.4654	20.4677	20.4607	20.4537	20.4491	20.4444	(88)
util rest of house	0.8547	0.7649	0.6509	0.5095	0.3773	0.2561	0.1754	0.1924	0.3183	0.5434	0.7661	0.8744	(89)
MIT 2	19.9955	20.1973	20.3391	20.4263	20.4493	20.4650	20.4654	20.4677	20.4594	20.4254	20.2521	19.9607	(90)
Living area fraction										fLA = Living area / (4) =		0.3233	(91)
MIT	20.1956	20.3869	20.5223	20.6037	20.6257	20.6378	20.6382	20.6397	20.6336	20.6016	20.4353	20.1604	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1956	20.3869	20.5223	20.6037	20.6257	20.6378	20.6382	20.6397	20.6336	20.6016	20.4353	20.1604	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8487	0.7632	0.6541	0.5157	0.3846	0.2636	0.1833	0.2005	0.3269	0.5508	0.7656	0.8678	(94)
Useful gains	717.0448	755.3875	720.1823	608.4668	467.4204	310.0983	207.4891	216.8351	338.2800	514.8977	637.8073	692.3806	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	865.6011	839.6879	756.9667	617.9850	469.1922	310.2579	207.5054	216.8614	338.8222	525.7509	707.2840	854.0572	(97)
Space heating kWh	110.5259	56.6499	27.3675	6.8531	1.3182	0.0000	0.0000	0.0000	0.0000	8.0748	50.0233	120.2874	(98a)
Space heating requirement - total per year (kWh/year)												381.1002	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	110.5259	56.6499	27.3675	6.8531	1.3182	0.0000	0.0000	0.0000	0.0000	8.0748	50.0233	120.2874	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												381.1002	
Space heating per m2											(98c) / (4) =	4.1591	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 100.0000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	110.5259	56.6499	27.3675	6.8531	1.3182	0.0000	0.0000	0.0000	0.0000	8.0748	50.0233	120.2874	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	110.5259	56.6499	27.3675	6.8531	1.3182	0.0000	0.0000	0.0000	0.0000	8.0748	50.0233	120.2874	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	18.9277	17.0960	18.9277	18.3171	18.9277	18.3171	18.9277	18.9277	18.3171	18.9277	18.3171	18.9277	(231)
Lighting	24.5219	19.6724	17.7128	12.9771	10.0239	8.1896	9.1441	11.8859	15.4386	20.2563	22.8795	25.2034	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-21.7229	-34.2517	-55.1813	-68.9038	-80.4545	-77.2515	-76.0210	-68.8008	-56.4551	-41.5599	-24.9218	-18.3337	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-4.5055	-10.7118	-24.0554	-40.3041	-56.4573	-58.0168	-57.1913	-46.3778	-31.7365	-16.6933	-6.4371	-3.4409	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 381.1002 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 100.0000

Water heating fuel used 2778.2442 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)

mechanical ventilation fans (SFP = 0.7420) 222.8585 (230a)

Total electricity for the above, kWh/year 222.8585 (231)

Electricity for lighting (calculated in Appendix L) 197.9055 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	-979.7858	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2600.3226	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	381.1002	16.4900	62.8434	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2778.2442	16.4900	458.1325	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	222.8585	16.4900	36.7494	(249)
Energy for lighting	197.9055	16.4900	32.6346	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-623.8580	16.4900	-102.8742	
PV Unit electricity exported	-355.9278	5.5900	-19.8964	
Total			-122.7705	(252)
Total energy cost			467.5893	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2320	(257)
SAP value		80.0288	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	381.1002	0.1592	60.6795	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2778.2442	0.1413	392.6311	(264)
Space and water heating			453.3106	(265)
Pumps, fans and electric keep-hot	222.8585	0.1387	30.9132	(267)
Energy for lighting	197.9055	0.1443	28.5639	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-623.8580	0.1325	-82.6425	
PV Unit electricity exported	-355.9278	0.1232	-43.8625	
Total			-126.5050	(269)
Total CO2, kg/year			386.2827	(272)
CO2 emissions per m2			4.2200	(273)
EI value			96.2115	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.4600	(1b)	x 2.6700	(2b) =	108.0282	(1b) - (3b)
First floor	51.1700	(1c)	x 2.7000	(2c) =	138.1590	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		246.1872	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door

Measured/design AP50												3.0000	(17)
Infiltration rate												0.1500	(18)
Number of sides sheltered												3	(19)
Shelter factor								(20) = 1 - [0.075 x (19)] =				0.7750	(20)
Infiltration rate adjusted to include shelter factor								(21) = (18) x (20) =				0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery		
If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.7500	1.2357	19.4629			(27)
Heatloss Floor 1			40.4600	0.1200	4.8552	75.0000	3034.5000	(28a)
External Wall 1	34.1400	15.7500	18.3900	0.1400	2.5746	14.0000	257.4600	(29a)
Total net area of external elements Aum(A, m2)			74.6000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.8927			(33)
Party Wall 1			93.4200	0.0000	0.0000	20.0000	1868.4000	(32)
Wall to corridor			36.1400	0.0000	0.0000	20.0000	722.8000	(32)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			223.5600			9.0000	2012.0400	(32c)
Internal Floor 1			51.1700			0.0000	0.0000	(32d)
Internal Ceiling 1			40.4600			9.0000	364.1400	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12352.9400	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	134.8133	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	6.7900	0.0500	0.3395
E4 Jamb	18.5500	0.0500	0.9275
E5 Ground floor (normal)	5.9500	0.1600	0.9520
E18 Party wall between dwellings	6.0700	0.0600	0.3642
P1 Party wall - Ground floor	19.5500	0.0800	1.5640
E6 Intermediate floor within a dwelling	5.9500	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.1472	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	31.0399	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.6515	23.6515	23.1793	21.7626	21.5265	20.5821	20.1099	20.1099	21.0543	22.2349	22.7071	22.4710	(38)
Heat transfer coeff	54.6914	54.6914	54.2192	52.8026	52.5665	51.6220	51.1498	51.1498	52.0942	53.2748	53.7470	53.5109	(39)
Average = Sum(39)m / 12 =												52.9600	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5969	0.5969	0.5917	0.5763	0.5737	0.5634	0.5582	0.5582	0.5685	0.5814	0.5866	0.5840	(40)
HLP (average)												0.5780	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6474	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	94.3355	92.9178	90.8520	86.8994	83.9824	80.7295	78.8805	80.9307	83.1782	86.6708	90.7083	93.9740	(42a)
Hot water usage for baths	29.6267	29.1867	28.5671	27.4247	26.5692	25.6207	25.1083	25.7236	26.3935	27.4085	28.5745	29.5266	(42b)
Hot water usage for other uses	41.7418	40.2239	38.7061	37.1882	35.6703	34.1524	34.1524	35.6703	37.1882	38.7061	40.2239	41.7418	(42c)
Average daily hot water use (litres/day)												152.3899	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	165.7040	162.3285	158.1251	151.5122	146.2220	140.5026	138.1413	142.3246	146.7598	152.7854	159.5067	165.2424	(44)
Energy conte	262.4347	231.1536	243.0325	207.4126	196.8429	172.7643	167.0699	176.2276	180.9695	207.3283	227.2466	258.7297	(45)
Energy content (annual)										Total = Sum(45)m =		2531.2122	
Distribution loss (46)m = 0.15 x (45)m	39.3652	34.6730	36.4549	31.1119	29.5264	25.9146	25.0605	26.4341	27.1454	31.0992	34.0870	38.8095	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(64)
										Total per year (kWh/year) = Sum(64)m =		2778.2442	(64)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

	104.0442	92.0189	97.5929	85.2079	82.2349	73.6873	72.3354	75.3803	76.4156	85.7213	91.8027	102.8123 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	28.0156	24.8832	20.2364	15.3202	11.4521	9.6683	10.4469	13.5793	18.2262	23.1423	27.0105	28.7942	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	361.2608	365.0096	355.5628	335.4518	310.0653	286.2055	270.2657	266.5170	275.9637	296.0747	321.4613	345.3210	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	(71)

Water heating gains (Table 5)

	139.8443	136.9329	131.1733	118.3443	110.5308	102.3435	97.2250	101.3176	106.1327	115.2168	127.5037	138.1885	(72)

Total internal gains

	635.6000	633.3049	613.4517	575.5956	538.5274	504.6966	484.4169	487.8932	506.8019	540.9131	582.4547	618.7830	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	15.7500	33.4622	0.6300	0.8270	0.7700	190.2894	(79)

Solar gains	190.2894	345.9491	494.6857	644.7453	714.8567	689.7496	673.2490	599.9794	530.8432	380.0563	234.2354	166.5382	(83)
Total gains	825.8894	979.2540	1108.1374	1220.3410	1253.3841	1194.4462	1157.6660	1087.8726	1037.6451	920.9694	816.6902	785.3213	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.7406	62.7406	63.2870	64.9849	65.2768	66.4711	67.0848	67.0848	65.8686	64.4089	63.8430	64.1247	
alpha	5.1827	5.1827	5.2191	5.3323	5.3518	5.4314	5.4723	5.4723	5.3912	5.2939	5.2562	5.2750	
util living area	0.8856	0.8077	0.7023	0.5546	0.4292	0.3365	0.2694	0.2913	0.4096	0.6281	0.8168	0.9011	(86)
MIT	20.5543	20.7324	20.8757	20.9671	20.9924	20.9984	20.9996	20.9994	20.9953	20.9482	20.7654	20.5210	(87)
Th 2	20.4328	20.4328	20.4375	20.4514	20.4537	20.4631	20.4677	20.4677	20.4584	20.4468	20.4421	20.4444	(88)
util rest of house	0.8737	0.7916	0.6827	0.5333	0.4070	0.3135	0.2459	0.2663	0.3831	0.6017	0.7986	0.8905	(89)
MIT 2	19.9204	20.1323	20.3026	20.4177	20.4466	20.4617	20.4675	20.4673	20.4544	20.3948	20.1836	19.8902	(90)
Living area fraction									fLA = Living area / (4) =			0.3233	(91)
MIT	20.1253	20.3262	20.4878	20.5953	20.6230	20.6352	20.6395	20.6393	20.6292	20.5737	20.3717	20.0941	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1253	20.3262	20.4878	20.5953	20.6230	20.6352	20.6395	20.6393	20.6292	20.5737	20.3717	20.0941	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8668	0.7885	0.6845	0.5389	0.4139	0.3209	0.2535	0.2744	0.3915	0.6078	0.7962	0.8833	(94)
Useful gains	715.8753	772.1300	758.4713	657.6777	518.8131	383.2731	293.4533	298.4963	406.2429	559.7734	650.2136	693.6692	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	887.3862	876.4983	807.2069	670.3450	521.6166	383.8203	293.5735	298.6799	407.8588	579.2935	740.1868	877.2620	(97)
Space heating kWh	127.6041	70.1355	36.2593	9.1205	2.0858	0.0000	0.0000	0.0000	0.0000	14.5230	64.7807	136.5930	(98a)
Space heating requirement - total per year (kWh/year)												461.1019	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	127.6041	70.1355	36.2593	9.1205	2.0858	0.0000	0.0000	0.0000	0.0000	14.5230	64.7807	136.5930	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												461.1019	
Space heating per m2											(98c) / (4) =	5.0322	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	127.6041	70.1355	36.2593	9.1205	2.0858	0.0000	0.0000	0.0000	0.0000	14.5230	64.7807	136.5930	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	127.6041	70.1355	36.2593	9.1205	2.0858	0.0000	0.0000	0.0000	0.0000	14.5230	64.7807	136.5930	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating
Water heating requirement

	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	18.9277	17.0960	18.9277	18.3171	18.9277	18.3171	18.9277	18.9277	18.3171	18.9277	18.3171	18.9277 (231)
Lighting	24.5219	19.6724	17.7128	12.9771	10.0239	8.1896	9.1441	11.8859	15.4386	20.2563	22.8795	25.2034 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-19.7117	-33.0439	-55.3130	-71.8302	-83.2504	-78.3437	-77.7327	-68.8212	-56.0902	-39.9181	-23.2317	-16.9672 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-3.7958	-9.9380	-23.8966	-43.3515	-60.1812	-59.6171	-59.7171	-46.4038	-31.3643	-15.4332	-5.6445	-2.9971 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year

Space heating fuel - main system 1	461.1019 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2778.2442 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	222.8585 (230a)
Total electricity for the above, kWh/year	222.8585 (231)
Electricity for lighting (calculated in Appendix L)	197.9055 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-986.5945 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2673.5156 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	461.1019	25.1600	116.0132	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2778.2442	25.1600	699.0062	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	222.8585	25.1600	56.0712	(249)
Energy for lighting	197.9055	25.1600	49.7930	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-624.2542	25.1600	-157.0624	
PV Unit electricity exported	-362.3403	5.8100	-21.0520	
Total			-178.1143	(252)
Total energy cost			742.7694	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	461.1019	0.1587	73.1700	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2778.2442	0.1413	392.6311	(264)
Space and water heating			465.8012	(265)
Pumps, fans and electric keep-hot	222.8585	0.1387	30.9132	(267)
Energy for lighting	197.9055	0.1443	28.5639	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-624.2542	0.1322	-82.5068	
PV Unit electricity exported	-362.3403	0.1227	-44.4634	
Total			-126.9702	(269)
Total CO2, kg/year			398.3081	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	461.1019	1.5873	731.9242	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2778.2442	1.5226	4230.1104	(278)
Space and water heating			4962.0346	(279)
Pumps, fans and electric keep-hot	222.8585	1.5128	337.1403	(281)
Energy for lighting	197.9055	1.5338	303.5541	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-624.2542	1.4883	-929.1044	
PV Unit electricity exported	-362.3403	0.4503	-163.1786	
Total			-1092.2830	(283)
Total Primary energy kWh/year			4510.4460	(286)

SAP 10 EPC IMPROVEMENTS

Unit 383 TH_Copy

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N	Solar water heating		Not applicable
U	Solar photovoltaic panels		Not applicable
V2	Wind turbine		Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 80
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£921	£921	£0
Space heating	£172	£172	£0
Water heating	£699	£699	£0
Lighting	£50	£50	£0
Generated (PV)	-£178	-£178	£0
Total cost of fuels	£743	£743	£0
Total cost of uses	£743	£743	£0
Delivered energy	29 kWh/m²	29 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	4 kg/m²	4 kg/m²	0 kg/m²
Primary energy	49 kWh/m²	49 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.4600 (1b)	x	2.6700 (2b)	=	108.0282	(1b) - (3b)
First floor	51.1700 (1c)	x	2.7000 (2c)	=	138.1590	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.1872	(5)

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2. Ventilation rate
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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.7500	1.2357	19.4629			(27)
Heatloss Floor 1			40.4600	0.1200	4.8552	75.0000	3034.5000	(28a)
External Wall 1	34.1400	15.7500	18.3900	0.1400	2.5746	14.0000	257.4600	(29a)
Total net area of external elements Aum(A, m2)			74.6000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.8927			(33)
Party Wall 1			93.4200	0.0000	0.0000	20.0000	1868.4000	(32)
Wall to corridor			36.1400	0.0000	0.0000	20.0000	722.8000	(32)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			223.5600			9.0000	2012.0400	(32c)
Internal Floor 1			51.1700			0.0000	0.0000	(32d)
Internal Ceiling 1			40.4600			9.0000	364.1400	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12352.9400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 134.8133 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	6.7900	0.0500	0.3395
E4 Jamb	18.5500	0.0500	0.9275
E5 Ground floor (normal)	5.9500	0.1600	0.9520
E18 Party wall between dwellings	6.0700	0.0600	0.3642
P1 Party wall - Ground floor	19.5500	0.0800	1.5640
E6 Intermediate floor within a dwelling	5.9500	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.1472 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 31.0399 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.4154	23.1793	22.9432	21.7626	21.5265	20.3460	20.3460	20.1099	20.8182	21.5265	21.9987	22.4710	(38)
Heat transfer coeff	54.4553	54.2192	53.9831	52.8026	52.5665	51.3859	51.3859	51.1498	51.8581	52.5665	53.0387	53.5109	(39)
Average = Sum(39)m / 12 =												52.7435	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5943	0.5917	0.5891	0.5763	0.5737	0.5608	0.5608	0.5582	0.5660	0.5737	0.5788	0.5840	(40)
HLP (average)												0.5756	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6474 (42)
Hot water usage for mixer showers

94.3355	92.9178	90.8520	86.8994	83.9824	80.7295	78.8805	80.9307	83.1782	86.6708	90.7083	93.9740	(42a)

Hot water usage for baths

29.6267	29.1867	28.5671	27.4247	26.5692	25.6207	25.1083	25.7236	26.3935	27.4085	28.5745	29.5266	(42b)

Hot water usage for other uses

41.7418	40.2239	38.7061	37.1882	35.6703	34.1524	34.1524	35.6703	37.1882	38.7061	40.2239	41.7418	(42c)

Average daily hot water use (litres/day) 152.3899 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	165.7040	162.3285	158.1251	151.5122	146.2220	140.5026	138.1413	142.3246	146.7598	152.7854	159.5067	165.2424	(44)
Energy conte	262.4347	231.1536	243.0325	207.4126	196.8429	172.7643	167.0699	176.2276	180.9695	207.3283	227.2466	258.7297	(45)
Energy content (annual)										Total = Sum(45)m =		2531.2122	
Distribution loss (46)m = 0.15 x (45)m	39.3652	34.6730	36.4549	31.1119	29.5264	25.9146	25.0605	26.4341	27.1454	31.0992	34.0870	38.8095	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(64)

Total per year (kWh/year) = Sum(64)m = 2778.2442 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

104.0442	92.0189	97.5929	85.2079	82.2349	73.6873	72.3354	75.3803	76.4156	85.7213	91.8027	102.8123	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.0156	24.8832	20.2364	15.3202	11.4521	9.6683	10.4469	13.5793	18.2262	23.1423	27.0105	28.7942	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	361.2608	365.0096	355.5628	335.4518	310.0653	286.2055	270.2657	266.5170	275.9637	296.0747	321.4613	345.3210	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	(71)
Water heating gains (Table 5)													
	139.8443	136.9329	131.1733	118.3443	110.5308	102.3435	97.2250	101.3176	106.1327	115.2168	127.5037	138.1885	(72)
Total internal gains													
	635.6000	633.3049	613.4517	575.5956	538.5274	504.6966	484.4169	487.8932	506.8019	540.9131	582.4547	618.7830	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	15.7500	36.7938	0.6300	0.8270	0.7700	209.2353	(79)

Solar gains	209.2353	356.4051	487.6489	604.2207	676.7775	671.8834	647.7673	593.6367	528.0207	393.9035	250.6156	179.0618	(83)
Total gains	844.8352	989.7099	1101.1007	1179.8163	1215.3049	1176.5800	1132.1842	1081.5299	1034.8226	934.8166	833.0703	797.8448	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.0126	63.2870	63.5638	64.9849	65.2768	66.7765	66.7765	67.0848	66.1684	65.2768	64.6957	64.1247	
alpha	5.2008	5.2191	5.2376	5.3323	5.3518	5.4518	5.4518	5.4723	5.4112	5.3518	5.3130	5.2750	
util living area	0.8680	0.7823	0.6718	0.5319	0.4004	0.2793	0.1997	0.2175	0.3451	0.5706	0.7861	0.8863	(86)
MIT	20.6145	20.7838	20.9057	20.9750	20.9951	20.9995	20.9999	20.9999	20.9983	20.9707	20.8187	20.5786	(87)
Th 2	20.4351	20.4375	20.4398	20.4514	20.4537	20.4654	20.4654	20.4677	20.4607	20.4537	20.4491	20.4444	(88)
util rest of house	0.8547	0.7649	0.6509	0.5095	0.3773	0.2561	0.1754	0.1924	0.3183	0.5434	0.7661	0.8744	(89)
MIT 2	19.9955	20.1973	20.3391	20.4263	20.4493	20.4650	20.4654	20.4677	20.4594	20.4254	20.2521	19.9607	(90)
Living area fraction										fLA = Living area / (4) =		0.3233	(91)
MIT	20.1956	20.3869	20.5223	20.6037	20.6257	20.6378	20.6382	20.6397	20.6336	20.6016	20.4353	20.1604	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1956	20.3869	20.5223	20.6037	20.6257	20.6378	20.6382	20.6397	20.6336	20.6016	20.4353	20.1604	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8487	0.7632	0.6541	0.5157	0.3846	0.2636	0.1833	0.2005	0.3269	0.5508	0.7656	0.8678	(94)
Useful gains	717.0448	755.3875	720.1823	608.4668	467.4204	310.0983	207.4891	216.8351	338.2800	514.8977	637.8073	692.3806	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	865.6011	839.6879	756.9667	617.9850	469.1922	310.2579	207.5054	216.8614	338.8222	525.7509	707.2840	854.0572	(97)
Space heating kWh	110.5259	56.6499	27.3675	6.8531	1.3182	0.0000	0.0000	0.0000	0.0000	8.0748	50.0233	120.2874	(98a)
Space heating requirement - total per year (kWh/year)												381.1002	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	110.5259	56.6499	27.3675	6.8531	1.3182	0.0000	0.0000	0.0000	0.0000	8.0748	50.0233	120.2874	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												381.1002	
Space heating per m2											(98c) / (4) =	4.1591	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	110.5259	56.6499	27.3675	6.8531	1.3182	0.0000	0.0000	0.0000	0.0000	8.0748	50.0233	120.2874	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	110.5259	56.6499	27.3675	6.8531	1.3182	0.0000	0.0000	0.0000	0.0000	8.0748	50.0233	120.2874	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	18.9277	17.0960	18.9277	18.3171	18.9277	18.3171	18.9277	18.9277	18.3171	18.9277	18.3171	18.9277	(231)
Lighting	24.5219	19.6724	17.7128	12.9771	10.0239	8.1896	9.1441	11.8859	15.4386	20.2563	22.8795	25.2034	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-21.7229	-34.2517	-55.1813	-68.9038	-80.4545	-77.2515	-76.0210	-68.8008	-56.4551	-41.5599	-24.9218	-18.3337	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													

(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-4.5055	-10.7118	-24.0554	-40.3041	-56.4573	-58.0168	-57.1913	-46.3778	-31.7365	-16.6933	-6.4371	-3.4409	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	381.1002	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2778.2442	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	222.8585	(230a)
Total electricity for the above, kWh/year	222.8585	(231)
Electricity for lighting (calculated in Appendix L)	197.9055	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-979.7858	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2600.3226	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	381.1002	16.4900	62.8434	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2778.2442	16.4900	458.1325	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	222.8585	16.4900	36.7494	(249)
Energy for lighting	197.9055	16.4900	32.6346	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-623.8580	16.4900	-102.8742	
PV Unit electricity exported	-355.9278	5.5900	-19.8964	
Total			-122.7705	(252)
Total energy cost			467.5893	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2320	(257)
SAP value	80.0288	
SAP rating (Section 12)	80	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	381.1002	0.1592	60.6795	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2778.2442	0.1413	392.6311	(264)
Space and water heating			453.3106	(265)
Pumps, fans and electric keep-hot	222.8585	0.1387	30.9132	(267)
Energy for lighting	197.9055	0.1443	28.5639	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-623.8580	0.1325	-82.6425	
PV Unit electricity exported	-355.9278	0.1232	-43.8625	
Total			-126.5050	(269)
Total CO2, kg/year			386.2827	(272)
CO2 emissions per m2			4.2200	(273)
EI value			96.2115	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

Area	Storey height	Volume

	(m2)		(m)		(m3)	
Ground floor	40.4600 (1b)	x	2.6700 (2b)	=	108.0282	(1b) - (3b)
First floor	51.1700 (1c)	x	2.7000 (2c)	=	138.1590	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.1872	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.7500	1.2357	19.4629			(27)
Heatloss Floor 1			40.4600	0.1200	4.8552	75.0000	3034.5000	(28a)
External Wall 1	34.1400	15.7500	18.3900	0.1400	2.5746	14.0000	257.4600	(29a)
Total net area of external elements Aum(A, m2)			74.6000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.8927			(33)
Party Wall 1			93.4200	0.0000	0.0000	20.0000	1868.4000	(32)
Wall to corridor			36.1400	0.0000	0.0000	20.0000	722.8000	(32)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			223.5600			9.0000	2012.0400	(32c)
Internal Floor 1			51.1700			0.0000	0.0000	(32d)
Internal Ceiling 1			40.4600			9.0000	364.1400	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12352.9400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		134.8133 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	6.7900	0.0500	0.3395
E4 Jamb	18.5500	0.0500	0.9275
E5 Ground floor (normal)	5.9500	0.1600	0.9520
E18 Party wall between dwellings	6.0700	0.0600	0.3642
P1 Party wall - Ground floor	19.5500	0.0800	1.5640
E6 Intermediate floor within a dwelling	5.9500	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.1472 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	31.0399 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.6515	23.6515	23.1793	21.7626	21.5265	20.5821	20.1099	20.1099	21.0543	22.2349	22.7071	22.4710	(38)
Heat transfer coeff	54.6914	54.6914	54.2192	52.8026	52.5665	51.6220	51.1498	51.1498	52.0942	53.2748	53.7470	53.5109	(39)
Average = Sum(39)m / 12 =												52.9600	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5969	0.5969	0.5917	0.5763	0.5737	0.5634	0.5582	0.5582	0.5685	0.5814	0.5866	0.5840	(40)
HLP (average)												0.5780	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6474 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
94.3355	92.9178	90.8520	86.8994	83.9824	80.7295	78.8805	80.9307	83.1782	86.6708	90.7083	93.9740	(42a)

Hot water usage for baths

29.6267	29.1867	28.5671	27.4247	26.5692	25.6207	25.1083	25.7236	26.3935	27.4085	28.5745	29.5266	(42b)

Hot water usage for other uses

41.7418	40.2239	38.7061	37.1882	35.6703	34.1524	34.1524	35.6703	37.1882	38.7061	40.2239	41.7418	(42c)

Average daily hot water use (litres/day)	152.3899 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

	165.7040	162.3285	158.1251	151.5122	146.2220	140.5026	138.1413	142.3246	146.7598	152.7854	159.5067	165.2424	(44)
Energy conte	262.4347	231.1536	243.0325	207.4126	196.8429	172.7643	167.0699	176.2276	180.9695	207.3283	227.2466	258.7297	(45)
Energy content (annual)											Total = Sum(45)m =	2531.2122	
Distribution loss (46)m = 0.15 x (45)m													
	39.3652	34.6730	36.4549	31.1119	29.5264	25.9146	25.0605	26.4341	27.1454	31.0992	34.0870	38.8095	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(64)
										Total per year (kWh/year) = Sum(64)m =		2778.2442	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	104.0442	92.0189	97.5929	85.2079	82.2349	73.6873	72.3354	75.3803	76.4156	85.7213	91.8027	102.8123	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.0156	24.8832	20.2364	15.3202	11.4521	9.6683	10.4469	13.5793	18.2262	23.1423	27.0105	28.7942	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	361.2608	365.0096	355.5628	335.4518	310.0653	286.2055	270.2657	266.5170	275.9637	296.0747	321.4613	345.3210	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	(71)
Water heating gains (Table 5)													
	139.8443	136.9329	131.1733	118.3443	110.5308	102.3435	97.2250	101.3176	106.1327	115.2168	127.5037	138.1885	(72)
Total internal gains													
	635.6000	633.3049	613.4517	575.5956	538.5274	504.6966	484.4169	487.8932	506.8019	540.9131	582.4547	618.7830	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	15.7500	33.4622	0.6300	0.8270	0.7700	190.2894	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	190.2894	345.9491	494.6857	644.7453	714.8567	689.7496	673.2490	599.9794	530.8432	380.0563	234.2354	166.5382	(83)
Total gains	825.8894	979.2540	1108.1374	1220.3410	1253.3841	1194.4462	1157.6660	1087.8726	1037.6451	920.9694	816.6902	785.3213	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.7406	62.7406	63.2870	64.9849	65.2768	66.4711	67.0848	67.0848	65.8686	64.4089	63.8430	64.1247	
alpha	5.1827	5.1827	5.2191	5.3323	5.3518	5.4314	5.4723	5.4723	5.3912	5.2939	5.2562	5.2750	
util living area													
	0.8856	0.8077	0.7023	0.5546	0.4292	0.3365	0.2694	0.2913	0.4096	0.6281	0.8168	0.9011	(86)
MIT	20.5543	20.7324	20.8757	20.9671	20.9924	20.9984	20.9996	20.9994	20.9953	20.9482	20.7654	20.5210	(87)
Th 2	20.4328	20.4328	20.4375	20.4514	20.4537	20.4631	20.4677	20.4677	20.4584	20.4468	20.4421	20.4444	(88)
util rest of house													
	0.8737	0.7916	0.6827	0.5333	0.4070	0.3135	0.2459	0.2663	0.3831	0.6017	0.7986	0.8905	(89)
MIT 2	19.9204	20.1323	20.3026	20.4177	20.4466	20.4617	20.4675	20.4673	20.4544	20.3948	20.1836	19.8902	(90)
Living area fraction									fLA = Living area / (4) =			0.3233	(91)
MIT	20.1253	20.3262	20.4878	20.5953	20.6230	20.6352	20.6395	20.6393	20.6292	20.5737	20.3717	20.0941	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1253	20.3262	20.4878	20.5953	20.6230	20.6352	20.6395	20.6393	20.6292	20.5737	20.3717	20.0941	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8668	0.7885	0.6845	0.5389	0.4139	0.3209	0.2535	0.2744	0.3915	0.6078	0.7962	0.8833	(94)
Useful gains	715.8753	772.1300	758.4713	657.6777	518.8131	383.2731	293.4533	298.4963	406.2429	559.7734	650.2136	693.6692	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	887.3862	876.4983	807.2069	670.3450	521.6166	383.8203	293.5735	298.6799	407.8588	579.2935	740.1868	877.2620	(97)
Space heating kWh													
	127.6041	70.1355	36.2593	9.1205	2.0858	0.0000	0.0000	0.0000	0.0000	14.5230	64.7807	136.5930	(98a)
Space heating requirement - total per year (kWh/year)												461.1019	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	127.6041	70.1355	36.2593	9.1205	2.0858	0.0000	0.0000	0.0000	0.0000	14.5230	64.7807	136.5930	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 461.1019
Space heating per m2 (98c) / (4) = 5.0322 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 100.0000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	127.6041	70.1355	36.2593	9.1205	2.0858	0.0000	0.0000	0.0000	0.0000	14.5230	64.7807	136.5930	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	127.6041	70.1355	36.2593	9.1205	2.0858	0.0000	0.0000	0.0000	0.0000	14.5230	64.7807	136.5930	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	18.9277	17.0960	18.9277	18.3171	18.9277	18.3171	18.9277	18.9277	18.3171	18.9277	18.3171	18.9277	(231)
Lighting	24.5219	19.6724	17.7128	12.9771	10.0239	8.1896	9.1441	11.8859	15.4386	20.2563	22.8795	25.2034	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-19.7117	-33.0439	-55.3130	-71.8302	-83.2504	-78.3437	-77.7327	-68.8212	-56.0902	-39.9181	-23.2317	-16.9672	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.7958	-9.9380	-23.8966	-43.3515	-60.1812	-59.6171	-59.7171	-46.4038	-31.3643	-15.4332	-5.6445	-2.9971	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year
Space heating fuel - main system 1 461.1019 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 100.0000
Water heating fuel used 2778.2442 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)
mechanical ventilation fans (SFP = 0.7420) 222.8585 (230a)
Total electricity for the above, kWh/year 222.8585 (231)
Electricity for lighting (calculated in Appendix L) 197.9055 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation -986.5945 (233)
Wind generation 0.0000 (234)
Hydro-electric generation (Appendix N) 0.0000 (235a)
Electricity generated - Micro CHP (Appendix N) 0.0000 (235)
Appendix Q - special features
Energy saved or generated -0.0000 (236)
Energy used 0.0000 (237)
Total delivered energy for all uses 2673.5156 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	461.1019	25.1600	116.0132	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2778.2442	25.1600	699.0062	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	222.8585	25.1600	56.0712	(249)
Energy for lighting	197.9055	25.1600	49.7930	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-624.2542	25.1600	-157.0624	
PV Unit electricity exported	-362.3403	5.8100	-21.0520	
Total			-178.1143	(252)
Total energy cost			742.7694	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	461.1019	0.1587	73.1700	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2778.2442	0.1413	392.6311	(264)
Space and water heating			465.8012	(265)

Pumps, fans and electric keep-hot	222.8585	0.1387	30.9132	(267)
Energy for lighting	197.9055	0.1443	28.5639	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-624.2542	0.1322	-82.5068	
PV Unit electricity exported	-362.3403	0.1227	-44.4634	
Total			-126.9702	(269)
Total CO2, kg/year			398.3081	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	461.1019	1.5873	731.9242	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2778.2442	1.5226	4230.1104	(278)
Space and water heating			4962.0346	(279)
Pumps, fans and electric keep-hot	222.8585	1.5128	337.1403	(281)
Energy for lighting	197.9055	1.5338	303.5541	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-624.2542	1.4883	-929.1044	
PV Unit electricity exported	-362.3403	0.4503	-163.1786	
Total			-1092.2830	(283)
Total Primary energy kWh/year			4510.4460	(286)

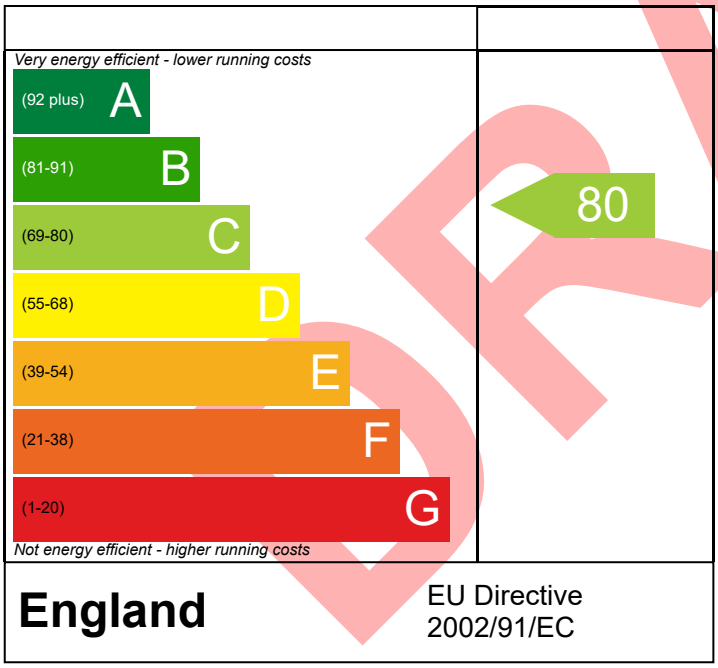
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	91.63 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

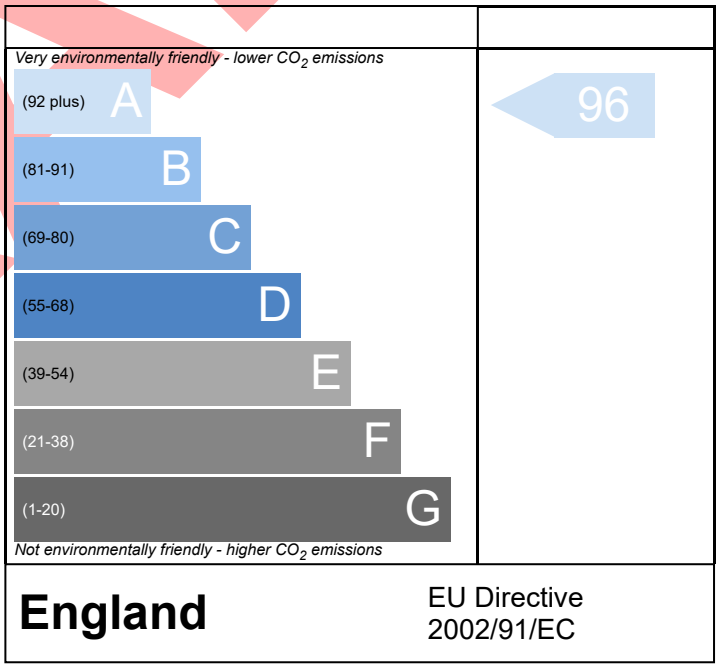
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:11

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	92 m^2
Site Reference	Unit 385 TH GF_Copy	Plot Reference	Unit 385 TH_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*9.89 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	4.3 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*53.17 kWh_{PE}/m^2*	
Dwelling primary energy	48.75 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*21.8 kWh/m^2*	
Dwelling fabric energy efficiency	20.1 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.12	Heatloss Floor 1 (0.12)	OK
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	18.39	0.14 **(!)**
Party wall: Party Wall (1)	93.42	0 **(!)**
Party wall: Party Wall (2)	36.14	0 **(!)**
Ground floor: Heatloss Floor 1, Heatloss Floor 1	40.46	0.12

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	15.75	South West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.16	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.08	
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0 **(!)**	
Party wall	P2: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	1.19 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 385 TH GF_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 385 TH_Copy	**Prop Type Ref**	Unit 385 TH GF
Property			

SAP Rating	80 C	**DER**	4.30	**TER**	9.89
Environmental	96 A	**% DER < TER**			56.52
CO_2 Emissions (t/year)	0.4	**DFEE**	20.09	**TFEE**	21.76
Compliance Check	See BREL	**% DFEE < TFEE**			7.69
% DPER < TPER	8.32	**DPER**	48.75	**TPER**	53.17

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.4600 (1b)	x	2.6700 (2b)	=	108.0282	(1b) - (3b)
First floor	51.1700 (1c)	x	2.7000 (2c)	=	138.1590	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.1872	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.7500	1.2357	19.4629			(27)
Heatloss Floor 1			40.4600	0.1200	4.8552	75.0000	3034.5000	(28a)
External Wall 1	34.1400	15.7500	18.3900	0.1400	2.5746	14.0000	257.4600	(29a)
Total net area of external elements Aum(A, m2)			74.6000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.8927			(33)
Party Wall 1			93.4200	0.0000	0.0000	20.0000	1868.4000	(32)
Wall to corridor			36.1400	0.0000	0.0000	20.0000	722.8000	(32)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			223.5600			9.0000	2012.0400	(32c)
Internal Floor 1			51.1700			0.0000	0.0000	(32d)
Internal Ceiling 1			40.4600			9.0000	364.1400	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12352.9400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		134.8133 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	6.7900	0.0500	0.3395
E4 Jamb	18.5500	0.0500	0.9275
E5 Ground floor (normal)	5.9500	0.1600	0.9520
E18 Party wall between dwellings	6.0700	0.0600	0.3642
P1 Party wall - Ground floor	19.5500	0.0800	1.5640
E6 Intermediate floor within a dwelling	5.9500	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.1472 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 31.0399 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.4154	23.1793	22.9432	21.7626	21.5265	20.3460	20.3460	20.1099	20.8182	21.5265	21.9987	22.4710	(38)
Heat transfer coeff	54.4553	54.2192	53.9831	52.8026	52.5665	51.3859	51.3859	51.1498	51.8581	52.5665	53.0387	53.5109	(39)

Average = Sum(39)m / 12 = 52.7435

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5943	0.5917	0.5891	0.5763	0.5737	0.5608	0.5608	0.5582	0.5660	0.5737	0.5788	0.5840	(40)
HLP (average)												0.5756	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6474 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	94.3355	92.9178	90.8520	86.8994	83.9824	80.7295	78.8805	80.9307	83.1782	86.6708	90.7083	93.9740	(42a)
Hot water usage for baths	29.6267	29.1867	28.5671	27.4247	26.5692	25.6207	25.1083	25.7236	26.3935	27.4085	28.5745	29.5266	(42b)
Hot water usage for other uses	41.7418	40.2239	38.7061	37.1882	35.6703	34.1524	34.1524	35.6703	37.1882	38.7061	40.2239	41.7418	(42c)

Average daily hot water use (litres/day) 152.3899 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	165.7040	162.3285	158.1251	151.5122	146.2220	140.5026	138.1413	142.3246	146.7598	152.7854	159.5067	165.2424	(44)
Energy conte	262.4347	231.1536	243.0325	207.4126	196.8429	172.7643	167.0699	176.2276	180.9695	207.3283	227.2466	258.7297	(45)

Energy content (annual) Total = Sum(45)m = 2531.2122

Distribution loss (46)m = 0.15 x (45)m	39.3652	34.6730	36.4549	31.1119	29.5264	25.9146	25.0605	26.4341	27.1454	31.0992	34.0870	38.8095	(46)

Water storage loss:

Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(64)

Total per year (kWh/year) = Sum(64)m = 2778.2442 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	104.0442	92.0189	97.5929	85.2079	82.2349	73.6873	72.3354	75.3803	76.4156	85.7213	91.8027	102.8123	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.0156	24.8832	20.2364	15.3202	11.4521	9.6683	10.4469	13.5793	18.2262	23.1423	27.0105	28.7942	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	361.2608	365.0096	355.5628	335.4518	310.0653	286.2055	270.2657	266.5170	275.9637	296.0747	321.4613	345.3210	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	(71)
Water heating gains (Table 5)	139.8443	136.9329	131.1733	118.3443	110.5308	102.3435	97.2250	101.3176	106.1327	115.2168	127.5037	138.1885	(72)
Total internal gains	635.6000	633.3049	613.4517	575.5956	538.5274	504.6966	484.4169	487.8932	506.8019	540.9131	582.4547	618.7830	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	15.7500	36.7938	0.6300	0.8270	0.7700	209.2353	(79)

Solar gains	209.2353	356.4051	487.6489	604.2207	676.7775	671.8834	647.7673	593.6367	528.0207	393.9035	250.6156	179.0618	(83)
Total gains	844.8352	989.7099	1101.1007	1179.8163	1215.3049	1176.5800	1132.1842	1081.5299	1034.8226	934.8166	833.0703	797.8448	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.0126	63.2870	63.5638	64.9849	65.2768	66.7765	66.7765	67.0848	66.1684	65.2768	64.6957	64.1247	
alpha	5.2008	5.2191	5.2376	5.3323	5.3518	5.4518	5.4518	5.4723	5.4112	5.3518	5.3130	5.2750	
util living area	0.8680	0.7823	0.6718	0.5319	0.4004	0.2793	0.1997	0.2175	0.3451	0.5706	0.7861	0.8863	(86)
MIT	20.6145	20.7838	20.9057	20.9750	20.9951	20.9995	20.9999	20.9999	20.9983	20.9707	20.8187	20.5786	(87)
Th 2	20.4351	20.4375	20.4398	20.4514	20.4537	20.4654	20.4654	20.4677	20.4607	20.4537	20.4491	20.4444	(88)
util rest of house	0.8547	0.7649	0.6509	0.5095	0.3773	0.2561	0.1754	0.1924	0.3183	0.5434	0.7661	0.8744	(89)
MIT 2	19.9955	20.1973	20.3391	20.4263	20.4493	20.4650	20.4654	20.4677	20.4594	20.4254	20.2521	19.9607	(90)
Living area fraction										fLA = Living area / (4) =		0.3233	(91)
MIT	20.1956	20.3869	20.5223	20.6037	20.6257	20.6378	20.6382	20.6397	20.6336	20.6016	20.4353	20.1604	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1956	20.3869	20.5223	20.6037	20.6257	20.6378	20.6382	20.6397	20.6336	20.6016	20.4353	20.1604	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8487	0.7632	0.6541	0.5157	0.3846	0.2636	0.1833	0.2005	0.3269	0.5508	0.7656	0.8678	(94)
Useful gains	717.0448	755.3875	720.1823	608.4668	467.4204	310.0983	207.4891	216.8351	338.2800	514.8977	637.8073	692.3806	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	865.6011	839.6879	756.9667	617.9850	469.1922	310.2579	207.5054	216.8614	338.8222	525.7509	707.2840	854.0572	(97)
Space heating kWh	110.5259	56.6499	27.3675	6.8531	1.3182	0.0000	0.0000	0.0000	0.0000	8.0748	50.0233	120.2874	(98a)
Space heating requirement - total per year (kWh/year)												381.1002	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	110.5259	56.6499	27.3675	6.8531	1.3182	0.0000	0.0000	0.0000	0.0000	8.0748	50.0233	120.2874	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												381.1002	
Space heating per m2											(98c) / (4) =	4.1591	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 100.0000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	110.5259	56.6499	27.3675	6.8531	1.3182	0.0000	0.0000	0.0000	0.0000	8.0748	50.0233	120.2874	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	110.5259	56.6499	27.3675	6.8531	1.3182	0.0000	0.0000	0.0000	0.0000	8.0748	50.0233	120.2874	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	18.9277	17.0960	18.9277	18.3171	18.9277	18.3171	18.9277	18.9277	18.3171	18.9277	18.3171	18.9277	(231)
Lighting	24.5219	19.6724	17.7128	12.9771	10.0239	8.1896	9.1441	11.8859	15.4386	20.2563	22.8795	25.2034	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-21.7229	-34.2517	-55.1813	-68.9038	-80.4545	-77.2515	-76.0210	-68.8008	-56.4551	-41.5599	-24.9218	-18.3337	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-4.5055	-10.7118	-24.0554	-40.3041	-56.4573	-58.0168	-57.1913	-46.3778	-31.7365	-16.6933	-6.4371	-3.4409	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 381.1002 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 100.0000

Water heating fuel used 2778.2442 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)

mechanical ventilation fans (SFP = 0.7420) 222.8585 (230a)

Total electricity for the above, kWh/year 222.8585 (231)

Electricity for lighting (calculated in Appendix L) 197.9055 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	-979.7858	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2600.3226	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	381.1002	16.4900	62.8434	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2778.2442	16.4900	458.1325	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	222.8585	16.4900	36.7494	(249)
Energy for lighting	197.9055	16.4900	32.6346	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-623.8580	16.4900	-102.8742	
PV Unit electricity exported	-355.9278	5.5900	-19.8964	
Total			-122.7705	(252)
Total energy cost			467.5893	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2320	(257)
SAP value		80.0288	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	381.1002	0.1592	60.6795	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2778.2442	0.1413	392.6311	(264)
Space and water heating			453.3106	(265)
Pumps, fans and electric keep-hot	222.8585	0.1387	30.9132	(267)
Energy for lighting	197.9055	0.1443	28.5639	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-623.8580	0.1325	-82.6425	
PV Unit electricity exported	-355.9278	0.1232	-43.8625	
Total			-126.5050	(269)
Total CO2, kg/year			386.2827	(272)
CO2 emissions per m2			4.2200	(273)
EI value			96.2115	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.4600	(1b)	x 2.6700	(2b) =	108.0282	(1b) - (3b)
First floor	51.1700	(1c)	x 2.7000	(2c) =	138.1590	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		246.1872	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door

Measured/design AP50												3.0000	(17)
Infiltration rate												0.1500	(18)
Number of sides sheltered												3	(19)
Shelter factor								(20) = 1 - [0.075 x (19)] =				0.7750	(20)
Infiltration rate adjusted to include shelter factor								(21) = (18) x (20) =				0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery		
If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.7500	1.2357	19.4629			(27)
Heatloss Floor 1			40.4600	0.1200	4.8552	75.0000	3034.5000	(28a)
External Wall 1	34.1400	15.7500	18.3900	0.1400	2.5746	14.0000	257.4600	(29a)
Total net area of external elements Aum(A, m2)			74.6000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.8927			(33)
Party Wall 1			93.4200	0.0000	0.0000	20.0000	1868.4000	(32)
Wall to corridor			36.1400	0.0000	0.0000	20.0000	722.8000	(32)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			223.5600			9.0000	2012.0400	(32c)
Internal Floor 1			51.1700			0.0000	0.0000	(32d)
Internal Ceiling 1			40.4600			9.0000	364.1400	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12352.9400	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	134.8133	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	6.7900	0.0500	0.3395
E4 Jamb	18.5500	0.0500	0.9275
E5 Ground floor (normal)	5.9500	0.1600	0.9520
E18 Party wall between dwellings	6.0700	0.0600	0.3642
P1 Party wall - Ground floor	19.5500	0.0800	1.5640
E6 Intermediate floor within a dwelling	5.9500	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.1472	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	31.0399	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.6515	23.6515	23.1793	21.7626	21.5265	20.5821	20.1099	20.1099	21.0543	22.2349	22.7071	22.4710	(38)
Heat transfer coeff	54.6914	54.6914	54.2192	52.8026	52.5665	51.6220	51.1498	51.1498	52.0942	53.2748	53.7470	53.5109	(39)
Average = Sum(39)m / 12 =												52.9600	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5969	0.5969	0.5917	0.5763	0.5737	0.5634	0.5582	0.5582	0.5685	0.5814	0.5866	0.5840	(40)
HLP (average)												0.5780	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6474	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	94.3355	92.9178	90.8520	86.8994	83.9824	80.7295	78.8805	80.9307	83.1782	86.6708	90.7083	93.9740	(42a)
Hot water usage for baths	29.6267	29.1867	28.5671	27.4247	26.5692	25.6207	25.1083	25.7236	26.3935	27.4085	28.5745	29.5266	(42b)
Hot water usage for other uses	41.7418	40.2239	38.7061	37.1882	35.6703	34.1524	34.1524	35.6703	37.1882	38.7061	40.2239	41.7418	(42c)
Average daily hot water use (litres/day)												152.3899	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	165.7040	162.3285	158.1251	151.5122	146.2220	140.5026	138.1413	142.3246	146.7598	152.7854	159.5067	165.2424	(44)
Energy conte	262.4347	231.1536	243.0325	207.4126	196.8429	172.7643	167.0699	176.2276	180.9695	207.3283	227.2466	258.7297	(45)
Energy content (annual)										Total = Sum(45)m =		2531.2122	
Distribution loss (46)m = 0.15 x (45)m	39.3652	34.6730	36.4549	31.1119	29.5264	25.9146	25.0605	26.4341	27.1454	31.0992	34.0870	38.8095	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(64)
										Total per year (kWh/year) = Sum(64)m =		2778.2442	(64)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

	104.0442	92.0189	97.5929	85.2079	82.2349	73.6873	72.3354	75.3803	76.4156	85.7213	91.8027	102.8123 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	28.0156	24.8832	20.2364	15.3202	11.4521	9.6683	10.4469	13.5793	18.2262	23.1423	27.0105	28.7942	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	361.2608	365.0096	355.5628	335.4518	310.0653	286.2055	270.2657	266.5170	275.9637	296.0747	321.4613	345.3210	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	(71)

Water heating gains (Table 5)

	139.8443	136.9329	131.1733	118.3443	110.5308	102.3435	97.2250	101.3176	106.1327	115.2168	127.5037	138.1885	(72)

Total internal gains

	635.6000	633.3049	613.4517	575.5956	538.5274	504.6966	484.4169	487.8932	506.8019	540.9131	582.4547	618.7830	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	15.7500	33.4622	0.6300	0.8270	0.7700	190.2894	(79)

Solar gains	190.2894	345.9491	494.6857	644.7453	714.8567	689.7496	673.2490	599.9794	530.8432	380.0563	234.2354	166.5382	(83)
Total gains	825.8894	979.2540	1108.1374	1220.3410	1253.3841	1194.4462	1157.6660	1087.8726	1037.6451	920.9694	816.6902	785.3213	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.7406	62.7406	63.2870	64.9849	65.2768	66.4711	67.0848	67.0848	65.8686	64.4089	63.8430	64.1247	
alpha	5.1827	5.1827	5.2191	5.3323	5.3518	5.4314	5.4723	5.4723	5.3912	5.2939	5.2562	5.2750	
util living area	0.8856	0.8077	0.7023	0.5546	0.4292	0.3365	0.2694	0.2913	0.4096	0.6281	0.8168	0.9011	(86)
MIT	20.5543	20.7324	20.8757	20.9671	20.9924	20.9984	20.9996	20.9994	20.9953	20.9482	20.7654	20.5210	(87)
Th 2	20.4328	20.4328	20.4375	20.4514	20.4537	20.4631	20.4677	20.4677	20.4584	20.4468	20.4421	20.4444	(88)
util rest of house	0.8737	0.7916	0.6827	0.5333	0.4070	0.3135	0.2459	0.2663	0.3831	0.6017	0.7986	0.8905	(89)
MIT 2	19.9204	20.1323	20.3026	20.4177	20.4466	20.4617	20.4675	20.4673	20.4544	20.3948	20.1836	19.8902	(90)
Living area fraction									fLA = Living area / (4) =			0.3233	(91)
MIT	20.1253	20.3262	20.4878	20.5953	20.6230	20.6352	20.6395	20.6393	20.6292	20.5737	20.3717	20.0941	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1253	20.3262	20.4878	20.5953	20.6230	20.6352	20.6395	20.6393	20.6292	20.5737	20.3717	20.0941	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8668	0.7885	0.6845	0.5389	0.4139	0.3209	0.2535	0.2744	0.3915	0.6078	0.7962	0.8833	(94)
Useful gains	715.8753	772.1300	758.4713	657.6777	518.8131	383.2731	293.4533	298.4963	406.2429	559.7734	650.2136	693.6692	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	887.3862	876.4983	807.2069	670.3450	521.6166	383.8203	293.5735	298.6799	407.8588	579.2935	740.1868	877.2620	(97)
Space heating kWh	127.6041	70.1355	36.2593	9.1205	2.0858	0.0000	0.0000	0.0000	0.0000	14.5230	64.7807	136.5930	(98a)
Space heating requirement - total per year (kWh/year)												461.1019	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	127.6041	70.1355	36.2593	9.1205	2.0858	0.0000	0.0000	0.0000	0.0000	14.5230	64.7807	136.5930	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												461.1019	
Space heating per m2											(98c) / (4) =	5.0322	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	127.6041	70.1355	36.2593	9.1205	2.0858	0.0000	0.0000	0.0000	0.0000	14.5230	64.7807	136.5930	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	127.6041	70.1355	36.2593	9.1205	2.0858	0.0000	0.0000	0.0000	0.0000	14.5230	64.7807	136.5930	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating
Water heating requirement

	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	18.9277	17.0960	18.9277	18.3171	18.9277	18.3171	18.9277	18.9277	18.3171	18.9277	18.3171	18.9277 (231)
Lighting	24.5219	19.6724	17.7128	12.9771	10.0239	8.1896	9.1441	11.8859	15.4386	20.2563	22.8795	25.2034 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-19.7117	-33.0439	-55.3130	-71.8302	-83.2504	-78.3437	-77.7327	-68.8212	-56.0902	-39.9181	-23.2317	-16.9672 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-3.7958	-9.9380	-23.8966	-43.3515	-60.1812	-59.6171	-59.7171	-46.4038	-31.3643	-15.4332	-5.6445	-2.9971 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year

Space heating fuel - main system 1	461.1019 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2778.2442 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	222.8585 (230a)
Total electricity for the above, kWh/year	222.8585 (231)
Electricity for lighting (calculated in Appendix L)	197.9055 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-986.5945 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2673.5156 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	461.1019	25.1600	116.0132	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2778.2442	25.1600	699.0062	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	222.8585	25.1600	56.0712	(249)
Energy for lighting	197.9055	25.1600	49.7930	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-624.2542	25.1600	-157.0624	
PV Unit electricity exported	-362.3403	5.8100	-21.0520	
Total			-178.1143	(252)
Total energy cost			742.7694	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	461.1019	0.1587	73.1700	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2778.2442	0.1413	392.6311	(264)
Space and water heating			465.8012	(265)
Pumps, fans and electric keep-hot	222.8585	0.1387	30.9132	(267)
Energy for lighting	197.9055	0.1443	28.5639	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-624.2542	0.1322	-82.5068	
PV Unit electricity exported	-362.3403	0.1227	-44.4634	
Total			-126.9702	(269)
Total CO2, kg/year			398.3081	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	461.1019	1.5873	731.9242	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2778.2442	1.5226	4230.1104	(278)
Space and water heating			4962.0346	(279)
Pumps, fans and electric keep-hot	222.8585	1.5128	337.1403	(281)
Energy for lighting	197.9055	1.5338	303.5541	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-624.2542	1.4883	-929.1044	
PV Unit electricity exported	-362.3403	0.4503	-163.1786	
Total			-1092.2830	(283)
Total Primary energy kWh/year			4510.4460	(286)

SAP 10 EPC IMPROVEMENTS

Unit 385 TH_Copy

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N Solar water heating — Not applicable
U Solar photovoltaic panels — Not applicable
V2 Wind turbine — Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 80
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£921	£921	£0
Space heating	£172	£172	£0
Water heating	£699	£699	£0
Lighting	£50	£50	£0
Generated (PV)	-£178	-£178	£0
Total cost of fuels	£743	£743	£0
Total cost of uses	£743	£743	£0
Delivered energy	29 kWh/m²	29 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	4 kg/m²	4 kg/m²	0 kg/m²
Primary energy	49 kWh/m²	49 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.4600 (1b)	x	2.6700 (2b)	=	108.0282 (1b)	- (3b)
First floor	51.1700 (1c)	x	2.7000 (2c)	=	138.1590 (1c)	- (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.1872	(5)

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2. Ventilation rate
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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.7500	1.2357	19.4629			(27)
Heatloss Floor 1			40.4600	0.1200	4.8552	75.0000	3034.5000	(28a)
External Wall 1	34.1400	15.7500	18.3900	0.1400	2.5746	14.0000	257.4600	(29a)
Total net area of external elements Aum(A, m2)			74.6000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.8927			(33)
Party Wall 1			93.4200	0.0000	0.0000	20.0000	1868.4000	(32)
Wall to corridor			36.1400	0.0000	0.0000	20.0000	722.8000	(32)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			223.5600			9.0000	2012.0400	(32c)
Internal Floor 1			51.1700			0.0000	0.0000	(32d)
Internal Ceiling 1			40.4600			9.0000	364.1400	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12352.9400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 134.8133 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	6.7900	0.0500	0.3395
E4 Jamb	18.5500	0.0500	0.9275
E5 Ground floor (normal)	5.9500	0.1600	0.9520
E18 Party wall between dwellings	6.0700	0.0600	0.3642
P1 Party wall - Ground floor	19.5500	0.0800	1.5640
E6 Intermediate floor within a dwelling	5.9500	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.1472 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 31.0399 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.4154	23.1793	22.9432	21.7626	21.5265	20.3460	20.3460	20.1099	20.8182	21.5265	21.9987	22.4710	(38)
Heat transfer coeff	54.4553	54.2192	53.9831	52.8026	52.5665	51.3859	51.3859	51.1498	51.8581	52.5665	53.0387	53.5109	(39)
Average = Sum(39)m / 12 =												52.7435	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5943	0.5917	0.5891	0.5763	0.5737	0.5608	0.5608	0.5582	0.5660	0.5737	0.5788	0.5840	(40)
HLP (average)												0.5756	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6474 (42)
Hot water usage for mixer showers

94.3355	92.9178	90.8520	86.8994	83.9824	80.7295	78.8805	80.9307	83.1782	86.6708	90.7083	93.9740	(42a)

Hot water usage for baths

29.6267	29.1867	28.5671	27.4247	26.5692	25.6207	25.1083	25.7236	26.3935	27.4085	28.5745	29.5266	(42b)

Hot water usage for other uses

41.7418	40.2239	38.7061	37.1882	35.6703	34.1524	34.1524	35.6703	37.1882	38.7061	40.2239	41.7418	(42c)

Average daily hot water use (litres/day) 152.3899 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	165.7040	162.3285	158.1251	151.5122	146.2220	140.5026	138.1413	142.3246	146.7598	152.7854	159.5067	165.2424	(44)
Energy conte	262.4347	231.1536	243.0325	207.4126	196.8429	172.7643	167.0699	176.2276	180.9695	207.3283	227.2466	258.7297	(45)
Energy content (annual)										Total = Sum(45)m =		2531.2122	
Distribution loss (46)m = 0.15 x (45)m	39.3652	34.6730	36.4549	31.1119	29.5264	25.9146	25.0605	26.4341	27.1454	31.0992	34.0870	38.8095	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(64)

Total per year (kWh/year) = Sum(64)m = 2778.2442 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

104.0442	92.0189	97.5929	85.2079	82.2349	73.6873	72.3354	75.3803	76.4156	85.7213	91.8027	102.8123	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.0156	24.8832	20.2364	15.3202	11.4521	9.6683	10.4469	13.5793	18.2262	23.1423	27.0105	28.7942	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	361.2608	365.0096	355.5628	335.4518	310.0653	286.2055	270.2657	266.5170	275.9637	296.0747	321.4613	345.3210	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	(71)
Water heating gains (Table 5)													
	139.8443	136.9329	131.1733	118.3443	110.5308	102.3435	97.2250	101.3176	106.1327	115.2168	127.5037	138.1885	(72)
Total internal gains													
	635.6000	633.3049	613.4517	575.5956	538.5274	504.6966	484.4169	487.8932	506.8019	540.9131	582.4547	618.7830	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	15.7500	36.7938	0.6300	0.8270	0.7700	209.2353	(79)

Solar gains	209.2353	356.4051	487.6489	604.2207	676.7775	671.8834	647.7673	593.6367	528.0207	393.9035	250.6156	179.0618	(83)
Total gains	844.8352	989.7099	1101.1007	1179.8163	1215.3049	1176.5800	1132.1842	1081.5299	1034.8226	934.8166	833.0703	797.8448	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.0126	63.2870	63.5638	64.9849	65.2768	66.7765	66.7765	67.0848	66.1684	65.2768	64.6957	64.1247	
alpha	5.2008	5.2191	5.2376	5.3323	5.3518	5.4518	5.4518	5.4723	5.4112	5.3518	5.3130	5.2750	
util living area	0.8680	0.7823	0.6718	0.5319	0.4004	0.2793	0.1997	0.2175	0.3451	0.5706	0.7861	0.8863	(86)
MIT	20.6145	20.7838	20.9057	20.9750	20.9951	20.9995	20.9999	20.9999	20.9983	20.9707	20.8187	20.5786	(87)
Th 2	20.4351	20.4375	20.4398	20.4514	20.4537	20.4654	20.4654	20.4677	20.4607	20.4537	20.4491	20.4444	(88)
util rest of house	0.8547	0.7649	0.6509	0.5095	0.3773	0.2561	0.1754	0.1924	0.3183	0.5434	0.7661	0.8744	(89)
MIT 2	19.9955	20.1973	20.3391	20.4263	20.4493	20.4650	20.4654	20.4677	20.4594	20.4254	20.2521	19.9607	(90)
Living area fraction										fLA = Living area / (4) =		0.3233	(91)
MIT	20.1956	20.3869	20.5223	20.6037	20.6257	20.6378	20.6382	20.6397	20.6336	20.6016	20.4353	20.1604	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1956	20.3869	20.5223	20.6037	20.6257	20.6378	20.6382	20.6397	20.6336	20.6016	20.4353	20.1604	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8487	0.7632	0.6541	0.5157	0.3846	0.2636	0.1833	0.2005	0.3269	0.5508	0.7656	0.8678	(94)
Useful gains	717.0448	755.3875	720.1823	608.4668	467.4204	310.0983	207.4891	216.8351	338.2800	514.8977	637.8073	692.3806	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	865.6011	839.6879	756.9667	617.9850	469.1922	310.2579	207.5054	216.8614	338.8222	525.7509	707.2840	854.0572	(97)
Space heating kWh	110.5259	56.6499	27.3675	6.8531	1.3182	0.0000	0.0000	0.0000	0.0000	8.0748	50.0233	120.2874	(98a)
Space heating requirement - total per year (kWh/year)												381.1002	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	110.5259	56.6499	27.3675	6.8531	1.3182	0.0000	0.0000	0.0000	0.0000	8.0748	50.0233	120.2874	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												381.1002	
Space heating per m2											(98c) / (4) =	4.1591	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	110.5259	56.6499	27.3675	6.8531	1.3182	0.0000	0.0000	0.0000	0.0000	8.0748	50.0233	120.2874	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	110.5259	56.6499	27.3675	6.8531	1.3182	0.0000	0.0000	0.0000	0.0000	8.0748	50.0233	120.2874	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	18.9277	17.0960	18.9277	18.3171	18.9277	18.3171	18.9277	18.9277	18.3171	18.9277	18.3171	18.9277	(231)
Lighting	24.5219	19.6724	17.7128	12.9771	10.0239	8.1896	9.1441	11.8859	15.4386	20.2563	22.8795	25.2034	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-21.7229	-34.2517	-55.1813	-68.9038	-80.4545	-77.2515	-76.0210	-68.8008	-56.4551	-41.5599	-24.9218	-18.3337	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													

(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-4.5055	-10.7118	-24.0554	-40.3041	-56.4573	-58.0168	-57.1913	-46.3778	-31.7365	-16.6933	-6.4371	-3.4409	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	381.1002	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2778.2442	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	222.8585	(230a)
Total electricity for the above, kWh/year	222.8585	(231)
Electricity for lighting (calculated in Appendix L)	197.9055	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-979.7858	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2600.3226	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	381.1002	16.4900	62.8434	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2778.2442	16.4900	458.1325	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	222.8585	16.4900	36.7494	(249)
Energy for lighting	197.9055	16.4900	32.6346	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-623.8580	16.4900	-102.8742	
PV Unit electricity exported	-355.9278	5.5900	-19.8964	
Total			-122.7705	(252)
Total energy cost			467.5893	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2320	(257)
SAP value	80.0288	
SAP rating (Section 12)	80	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	381.1002	0.1592	60.6795	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2778.2442	0.1413	392.6311	(264)
Space and water heating			453.3106	(265)
Pumps, fans and electric keep-hot	222.8585	0.1387	30.9132	(267)
Energy for lighting	197.9055	0.1443	28.5639	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-623.8580	0.1325	-82.6425	
PV Unit electricity exported	-355.9278	0.1232	-43.8625	
Total			-126.5050	(269)
Total CO2, kg/year			386.2827	(272)
CO2 emissions per m2			4.2200	(273)
EI value			96.2115	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

Area	Storey height	Volume

	(m2)		(m)		(m3)	
Ground floor	40.4600 (1b)	x	2.6700 (2b)	=	108.0282	(1b) - (3b)
First floor	51.1700 (1c)	x	2.7000 (2c)	=	138.1590	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.1872	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.7500	1.2357	19.4629			(27)
Heatloss Floor 1			40.4600	0.1200	4.8552	75.0000	3034.5000	(28a)
External Wall 1	34.1400	15.7500	18.3900	0.1400	2.5746	14.0000	257.4600	(29a)
Total net area of external elements Aum(A, m2)			74.6000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.8927			(33)
Party Wall 1			93.4200	0.0000	0.0000	20.0000	1868.4000	(32)
Wall to corridor			36.1400	0.0000	0.0000	20.0000	722.8000	(32)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			223.5600			9.0000	2012.0400	(32c)
Internal Floor 1			51.1700			0.0000	0.0000	(32d)
Internal Ceiling 1			40.4600			9.0000	364.1400	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12352.9400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		134.8133 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	6.7900	0.0500	0.3395
E4 Jamb	18.5500	0.0500	0.9275
E5 Ground floor (normal)	5.9500	0.1600	0.9520
E18 Party wall between dwellings	6.0700	0.0600	0.3642
P1 Party wall - Ground floor	19.5500	0.0800	1.5640
E6 Intermediate floor within a dwelling	5.9500	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.1472 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	31.0399 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.6515	23.6515	23.1793	21.7626	21.5265	20.5821	20.1099	20.1099	21.0543	22.2349	22.7071	22.4710	(38)
Heat transfer coeff	54.6914	54.6914	54.2192	52.8026	52.5665	51.6220	51.1498	51.1498	52.0942	53.2748	53.7470	53.5109	(39)
Average = Sum(39)m / 12 =												52.9600	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5969	0.5969	0.5917	0.5763	0.5737	0.5634	0.5582	0.5582	0.5685	0.5814	0.5866	0.5840	(40)
HLP (average)												0.5780	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6474 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
94.3355	92.9178	90.8520	86.8994	83.9824	80.7295	78.8805	80.9307	83.1782	86.6708	90.7083	93.9740	(42a)

Hot water usage for baths

29.6267	29.1867	28.5671	27.4247	26.5692	25.6207	25.1083	25.7236	26.3935	27.4085	28.5745	29.5266	(42b)

Hot water usage for other uses

41.7418	40.2239	38.7061	37.1882	35.6703	34.1524	34.1524	35.6703	37.1882	38.7061	40.2239	41.7418	(42c)

Average daily hot water use (litres/day)	152.3899 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

	165.7040	162.3285	158.1251	151.5122	146.2220	140.5026	138.1413	142.3246	146.7598	152.7854	159.5067	165.2424	(44)
Energy conte	262.4347	231.1536	243.0325	207.4126	196.8429	172.7643	167.0699	176.2276	180.9695	207.3283	227.2466	258.7297	(45)
Energy content (annual)											Total = Sum(45)m =	2531.2122	
Distribution loss (46)m = 0.15 x (45)m													
	39.3652	34.6730	36.4549	31.1119	29.5264	25.9146	25.0605	26.4341	27.1454	31.0992	34.0870	38.8095	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(64)
										Total per year (kWh/year) = Sum(64)m =		2778.2442	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	104.0442	92.0189	97.5929	85.2079	82.2349	73.6873	72.3354	75.3803	76.4156	85.7213	91.8027	102.8123	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.0156	24.8832	20.2364	15.3202	11.4521	9.6683	10.4469	13.5793	18.2262	23.1423	27.0105	28.7942	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	361.2608	365.0096	355.5628	335.4518	310.0653	286.2055	270.2657	266.5170	275.9637	296.0747	321.4613	345.3210	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	(71)
Water heating gains (Table 5)													
	139.8443	136.9329	131.1733	118.3443	110.5308	102.3435	97.2250	101.3176	106.1327	115.2168	127.5037	138.1885	(72)
Total internal gains													
	635.6000	633.3049	613.4517	575.5956	538.5274	504.6966	484.4169	487.8932	506.8019	540.9131	582.4547	618.7830	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	15.7500	33.4622	0.6300	0.8270	0.7700	190.2894	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	190.2894	345.9491	494.6857	644.7453	714.8567	689.7496	673.2490	599.9794	530.8432	380.0563	234.2354	166.5382	(83)
Total gains	825.8894	979.2540	1108.1374	1220.3410	1253.3841	1194.4462	1157.6660	1087.8726	1037.6451	920.9694	816.6902	785.3213	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.7406	62.7406	63.2870	64.9849	65.2768	66.4711	67.0848	67.0848	65.8686	64.4089	63.8430	64.1247	
alpha	5.1827	5.1827	5.2191	5.3323	5.3518	5.4314	5.4723	5.4723	5.3912	5.2939	5.2562	5.2750	
util living area													
	0.8856	0.8077	0.7023	0.5546	0.4292	0.3365	0.2694	0.2913	0.4096	0.6281	0.8168	0.9011	(86)
MIT	20.5543	20.7324	20.8757	20.9671	20.9924	20.9984	20.9996	20.9994	20.9953	20.9482	20.7654	20.5210	(87)
Th 2	20.4328	20.4328	20.4375	20.4514	20.4537	20.4631	20.4677	20.4677	20.4584	20.4468	20.4421	20.4444	(88)
util rest of house													
	0.8737	0.7916	0.6827	0.5333	0.4070	0.3135	0.2459	0.2663	0.3831	0.6017	0.7986	0.8905	(89)
MIT 2	19.9204	20.1323	20.3026	20.4177	20.4466	20.4617	20.4675	20.4673	20.4544	20.3948	20.1836	19.8902	(90)
Living area fraction									fLA = Living area / (4) =			0.3233	(91)
MIT	20.1253	20.3262	20.4878	20.5953	20.6230	20.6352	20.6395	20.6393	20.6292	20.5737	20.3717	20.0941	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1253	20.3262	20.4878	20.5953	20.6230	20.6352	20.6395	20.6393	20.6292	20.5737	20.3717	20.0941	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8668	0.7885	0.6845	0.5389	0.4139	0.3209	0.2535	0.2744	0.3915	0.6078	0.7962	0.8833	(94)
Useful gains	715.8753	772.1300	758.4713	657.6777	518.8131	383.2731	293.4533	298.4963	406.2429	559.7734	650.2136	693.6692	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	887.3862	876.4983	807.2069	670.3450	521.6166	383.8203	293.5735	298.6799	407.8588	579.2935	740.1868	877.2620	(97)
Space heating kWh													
	127.6041	70.1355	36.2593	9.1205	2.0858	0.0000	0.0000	0.0000	0.0000	14.5230	64.7807	136.5930	(98a)
Space heating requirement - total per year (kWh/year)												461.1019	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	127.6041	70.1355	36.2593	9.1205	2.0858	0.0000	0.0000	0.0000	0.0000	14.5230	64.7807	136.5930	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 461.1019
Space heating per m2 (98c) / (4) = 5.0322 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 100.0000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	127.6041	70.1355	36.2593	9.1205	2.0858	0.0000	0.0000	0.0000	0.0000	14.5230	64.7807	136.5930	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	127.6041	70.1355	36.2593	9.1205	2.0858	0.0000	0.0000	0.0000	0.0000	14.5230	64.7807	136.5930	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	18.9277	17.0960	18.9277	18.3171	18.9277	18.3171	18.9277	18.9277	18.3171	18.9277	18.3171	18.9277	(231)
Lighting	24.5219	19.6724	17.7128	12.9771	10.0239	8.1896	9.1441	11.8859	15.4386	20.2563	22.8795	25.2034	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-19.7117	-33.0439	-55.3130	-71.8302	-83.2504	-78.3437	-77.7327	-68.8212	-56.0902	-39.9181	-23.2317	-16.9672	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.7958	-9.9380	-23.8966	-43.3515	-60.1812	-59.6171	-59.7171	-46.4038	-31.3643	-15.4332	-5.6445	-2.9971	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year
Space heating fuel - main system 1 461.1019 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 100.0000
Water heating fuel used 2778.2442 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)
mechanical ventilation fans (SFP = 0.7420) 222.8585 (230a)
Total electricity for the above, kWh/year 222.8585 (231)
Electricity for lighting (calculated in Appendix L) 197.9055 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation -986.5945 (233)
Wind generation 0.0000 (234)
Hydro-electric generation (Appendix N) 0.0000 (235a)
Electricity generated - Micro CHP (Appendix N) 0.0000 (235)
Appendix Q - special features
Energy saved or generated -0.0000 (236)
Energy used 0.0000 (237)
Total delivered energy for all uses 2673.5156 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	461.1019	25.1600	116.0132	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2778.2442	25.1600	699.0062	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	222.8585	25.1600	56.0712	(249)
Energy for lighting	197.9055	25.1600	49.7930	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-624.2542	25.1600	-157.0624	
PV Unit electricity exported	-362.3403	5.8100	-21.0520	
Total			-178.1143	(252)
Total energy cost			742.7694	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	461.1019	0.1587	73.1700	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2778.2442	0.1413	392.6311	(264)
Space and water heating			465.8012	(265)

Pumps, fans and electric keep-hot	222.8585	0.1387	30.9132	(267)
Energy for lighting	197.9055	0.1443	28.5639	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-624.2542	0.1322	-82.5068	
PV Unit electricity exported	-362.3403	0.1227	-44.4634	
Total			-126.9702	(269)
Total CO2, kg/year			398.3081	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	461.1019	1.5873	731.9242	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2778.2442	1.5226	4230.1104	(278)
Space and water heating			4962.0346	(279)
Pumps, fans and electric keep-hot	222.8585	1.5128	337.1403	(281)
Energy for lighting	197.9055	1.5338	303.5541	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-624.2542	1.4883	-929.1044	
PV Unit electricity exported	-362.3403	0.4503	-163.1786	
Total			-1092.2830	(283)
Total Primary energy kWh/year			4510.4460	(286)

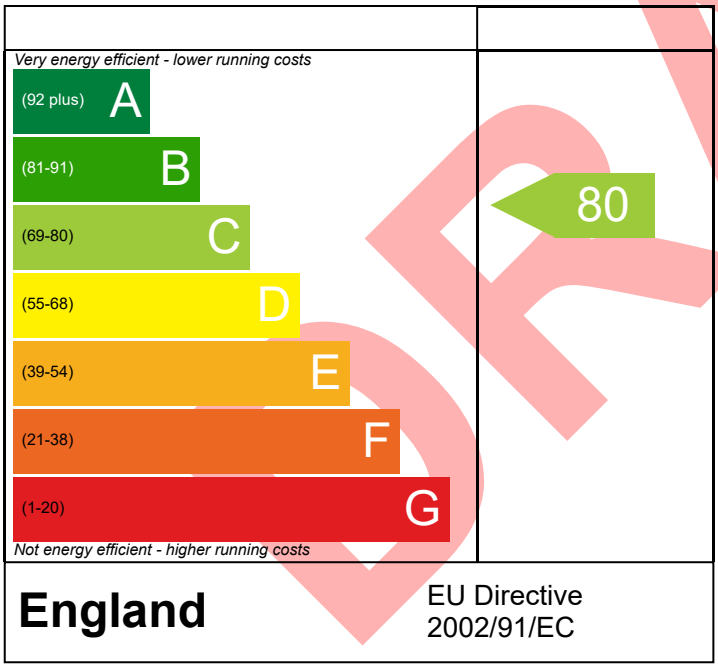
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	91.63 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

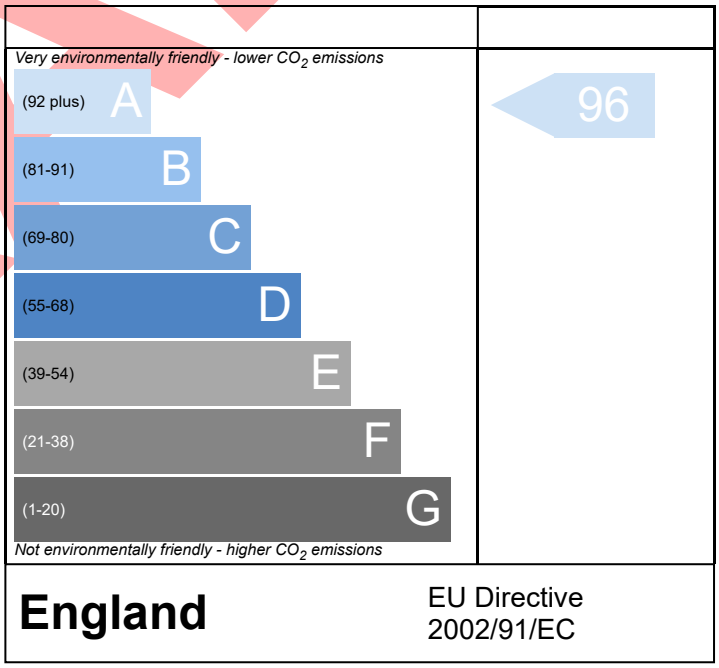
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:16

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	92 m^2
Site Reference	Unit 386 TH GF_Copy	Plot Reference	Unit 386 TH_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*9.89 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	4.3 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*53.17 kWh_{PE}/m^2*	
Dwelling primary energy	48.75 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*21.8 kWh/m^2*	
Dwelling fabric energy efficiency	20.1 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.12	Heatloss Floor 1 (0.12)	OK
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	18.39	0.14 **(!)**
Party wall: Party Wall (1)	93.42	0 **(!)**
Party wall: Party Wall (2)	36.14	0 **(!)**
Ground floor: Heatloss Floor 1, Heatloss Floor 1	40.46	0.12

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	15.75	South West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.16	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.08	
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0 **(!)**	
Party wall	P2: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	1.19 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 386 TH GF_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 386 TH_Copy	**Prop Type Ref**	Unit 386 TH GF
Property			

SAP Rating	80 C	**DER**	4.30	**TER**	9.89
Environmental	96 A	**% DER < TER**			56.52
CO_2 Emissions (t/year)	0.4	**DFEE**	20.09	**TFEE**	21.76
Compliance Check	See BREL	**% DFEE < TFEE**			7.69
% DPER < TPER	8.32	**DPER**	48.75	**TPER**	53.17

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.4600 (1b)	x	2.6700 (2b)	=	108.0282	(1b) - (3b)
First floor	51.1700 (1c)	x	2.7000 (2c)	=	138.1590	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.1872	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.7500	1.2357	19.4629			(27)
Heatloss Floor 1			40.4600	0.1200	4.8552	75.0000	3034.5000	(28a)
External Wall 1	34.1400	15.7500	18.3900	0.1400	2.5746	14.0000	257.4600	(29a)
Total net area of external elements Aum(A, m2)			74.6000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.8927			(33)
Party Wall 1			93.4200	0.0000	0.0000	20.0000	1868.4000	(32)
Wall to corridor			36.1400	0.0000	0.0000	20.0000	722.8000	(32)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			223.5600			9.0000	2012.0400	(32c)
Internal Floor 1			51.1700			0.0000	0.0000	(32d)
Internal Ceiling 1			40.4600			9.0000	364.1400	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12352.9400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		134.8133 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	6.7900	0.0500	0.3395
E4 Jamb	18.5500	0.0500	0.9275
E5 Ground floor (normal)	5.9500	0.1600	0.9520
E18 Party wall between dwellings	6.0700	0.0600	0.3642
P1 Party wall - Ground floor	19.5500	0.0800	1.5640
E6 Intermediate floor within a dwelling	5.9500	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.1472 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 31.0399 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.4154	23.1793	22.9432	21.7626	21.5265	20.3460	20.3460	20.1099	20.8182	21.5265	21.9987	22.4710	(38)
Heat transfer coeff	54.4553	54.2192	53.9831	52.8026	52.5665	51.3859	51.3859	51.1498	51.8581	52.5665	53.0387	53.5109	(39)

Average = Sum(39)m / 12 = 52.7435

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5943	0.5917	0.5891	0.5763	0.5737	0.5608	0.5608	0.5582	0.5660	0.5737	0.5788	0.5840	(40)
HLP (average)												0.5756	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6474 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	94.3355	92.9178	90.8520	86.8994	83.9824	80.7295	78.8805	80.9307	83.1782	86.6708	90.7083	93.9740	(42a)
Hot water usage for baths	29.6267	29.1867	28.5671	27.4247	26.5692	25.6207	25.1083	25.7236	26.3935	27.4085	28.5745	29.5266	(42b)
Hot water usage for other uses	41.7418	40.2239	38.7061	37.1882	35.6703	34.1524	34.1524	35.6703	37.1882	38.7061	40.2239	41.7418	(42c)

Average daily hot water use (litres/day) 152.3899 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	165.7040	162.3285	158.1251	151.5122	146.2220	140.5026	138.1413	142.3246	146.7598	152.7854	159.5067	165.2424	(44)
Energy conte	262.4347	231.1536	243.0325	207.4126	196.8429	172.7643	167.0699	176.2276	180.9695	207.3283	227.2466	258.7297	(45)

Energy content (annual) Total = Sum(45)m = 2531.2122

Distribution loss (46)m = 0.15 x (45)m	39.3652	34.6730	36.4549	31.1119	29.5264	25.9146	25.0605	26.4341	27.1454	31.0992	34.0870	38.8095	(46)

Water storage loss:

Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(64)

Total per year (kWh/year) = Sum(64)m = 2778.2442 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	104.0442	92.0189	97.5929	85.2079	82.2349	73.6873	72.3354	75.3803	76.4156	85.7213	91.8027	102.8123	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.0156	24.8832	20.2364	15.3202	11.4521	9.6683	10.4469	13.5793	18.2262	23.1423	27.0105	28.7942	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	361.2608	365.0096	355.5628	335.4518	310.0653	286.2055	270.2657	266.5170	275.9637	296.0747	321.4613	345.3210	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	(71)
Water heating gains (Table 5)	139.8443	136.9329	131.1733	118.3443	110.5308	102.3435	97.2250	101.3176	106.1327	115.2168	127.5037	138.1885	(72)
Total internal gains	635.6000	633.3049	613.4517	575.5956	538.5274	504.6966	484.4169	487.8932	506.8019	540.9131	582.4547	618.7830	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	15.7500	36.7938	0.6300	0.8270	0.7700	209.2353	(79)

Solar gains	209.2353	356.4051	487.6489	604.2207	676.7775	671.8834	647.7673	593.6367	528.0207	393.9035	250.6156	179.0618	(83)
Total gains	844.8352	989.7099	1101.1007	1179.8163	1215.3049	1176.5800	1132.1842	1081.5299	1034.8226	934.8166	833.0703	797.8448	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.0126	63.2870	63.5638	64.9849	65.2768	66.7765	66.7765	67.0848	66.1684	65.2768	64.6957	64.1247	
alpha	5.2008	5.2191	5.2376	5.3323	5.3518	5.4518	5.4518	5.4723	5.4112	5.3518	5.3130	5.2750	
util living area	0.8680	0.7823	0.6718	0.5319	0.4004	0.2793	0.1997	0.2175	0.3451	0.5706	0.7861	0.8863	(86)
MIT	20.6145	20.7838	20.9057	20.9750	20.9951	20.9995	20.9999	20.9999	20.9983	20.9707	20.8187	20.5786	(87)
Th 2	20.4351	20.4375	20.4398	20.4514	20.4537	20.4654	20.4654	20.4677	20.4607	20.4537	20.4491	20.4444	(88)
util rest of house	0.8547	0.7649	0.6509	0.5095	0.3773	0.2561	0.1754	0.1924	0.3183	0.5434	0.7661	0.8744	(89)
MIT 2	19.9955	20.1973	20.3391	20.4263	20.4493	20.4650	20.4654	20.4677	20.4594	20.4254	20.2521	19.9607	(90)
Living area fraction										fLA = Living area / (4) =		0.3233	(91)
MIT	20.1956	20.3869	20.5223	20.6037	20.6257	20.6378	20.6382	20.6397	20.6336	20.6016	20.4353	20.1604	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1956	20.3869	20.5223	20.6037	20.6257	20.6378	20.6382	20.6397	20.6336	20.6016	20.4353	20.1604	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8487	0.7632	0.6541	0.5157	0.3846	0.2636	0.1833	0.2005	0.3269	0.5508	0.7656	0.8678	(94)
Useful gains	717.0448	755.3875	720.1823	608.4668	467.4204	310.0983	207.4891	216.8351	338.2800	514.8977	637.8073	692.3806	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	865.6011	839.6879	756.9667	617.9850	469.1922	310.2579	207.5054	216.8614	338.8222	525.7509	707.2840	854.0572	(97)
Space heating kWh	110.5259	56.6499	27.3675	6.8531	1.3182	0.0000	0.0000	0.0000	0.0000	8.0748	50.0233	120.2874	(98a)
Space heating requirement - total per year (kWh/year)												381.1002	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	110.5259	56.6499	27.3675	6.8531	1.3182	0.0000	0.0000	0.0000	0.0000	8.0748	50.0233	120.2874	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												381.1002	
Space heating per m2											(98c) / (4) =	4.1591	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 100.0000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	110.5259	56.6499	27.3675	6.8531	1.3182	0.0000	0.0000	0.0000	0.0000	8.0748	50.0233	120.2874	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	110.5259	56.6499	27.3675	6.8531	1.3182	0.0000	0.0000	0.0000	0.0000	8.0748	50.0233	120.2874	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	18.9277	17.0960	18.9277	18.3171	18.9277	18.3171	18.9277	18.9277	18.3171	18.9277	18.3171	18.9277	(231)
Lighting	24.5219	19.6724	17.7128	12.9771	10.0239	8.1896	9.1441	11.8859	15.4386	20.2563	22.8795	25.2034	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-21.7229	-34.2517	-55.1813	-68.9038	-80.4545	-77.2515	-76.0210	-68.8008	-56.4551	-41.5599	-24.9218	-18.3337	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-4.5055	-10.7118	-24.0554	-40.3041	-56.4573	-58.0168	-57.1913	-46.3778	-31.7365	-16.6933	-6.4371	-3.4409	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 381.1002 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 100.0000

Water heating fuel used 2778.2442 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)

mechanical ventilation fans (SFP = 0.7420) 222.8585 (230a)

Total electricity for the above, kWh/year 222.8585 (231)

Electricity for lighting (calculated in Appendix L) 197.9055 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	-979.7858	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2600.3226	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	381.1002	16.4900	62.8434	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2778.2442	16.4900	458.1325	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	222.8585	16.4900	36.7494	(249)
Energy for lighting	197.9055	16.4900	32.6346	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-623.8580	16.4900	-102.8742	
PV Unit electricity exported	-355.9278	5.5900	-19.8964	
Total			-122.7705	(252)
Total energy cost			467.5893	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2320	(257)
SAP value		80.0288	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	381.1002	0.1592	60.6795	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2778.2442	0.1413	392.6311	(264)
Space and water heating			453.3106	(265)
Pumps, fans and electric keep-hot	222.8585	0.1387	30.9132	(267)
Energy for lighting	197.9055	0.1443	28.5639	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-623.8580	0.1325	-82.6425	
PV Unit electricity exported	-355.9278	0.1232	-43.8625	
Total			-126.5050	(269)
Total CO2, kg/year			386.2827	(272)
CO2 emissions per m2			4.2200	(273)
EI value			96.2115	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.4600	(1b)	x 2.6700	(2b) =	108.0282	(1b) - (3b)
First floor	51.1700	(1c)	x 2.7000	(2c) =	138.1590	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		246.1872	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door

Measured/design AP50												3.0000	(17)
Infiltration rate												0.1500	(18)
Number of sides sheltered												3	(19)
Shelter factor								(20) = 1 - [0.075 x (19)] =				0.7750	(20)
Infiltration rate adjusted to include shelter factor								(21) = (18) x (20) =				0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery		
If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.7500	1.2357	19.4629			(27)
Heatloss Floor 1			40.4600	0.1200	4.8552	75.0000	3034.5000	(28a)
External Wall 1	34.1400	15.7500	18.3900	0.1400	2.5746	14.0000	257.4600	(29a)
Total net area of external elements Aum(A, m2)			74.6000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.8927			(33)
Party Wall 1			93.4200	0.0000	0.0000	20.0000	1868.4000	(32)
Wall to corridor			36.1400	0.0000	0.0000	20.0000	722.8000	(32)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			223.5600			9.0000	2012.0400	(32c)
Internal Floor 1			51.1700			0.0000	0.0000	(32d)
Internal Ceiling 1			40.4600			9.0000	364.1400	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12352.9400	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	134.8133	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	6.7900	0.0500	0.3395
E4 Jamb	18.5500	0.0500	0.9275
E5 Ground floor (normal)	5.9500	0.1600	0.9520
E18 Party wall between dwellings	6.0700	0.0600	0.3642
P1 Party wall - Ground floor	19.5500	0.0800	1.5640
E6 Intermediate floor within a dwelling	5.9500	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.1472	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	31.0399	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.6515	23.6515	23.1793	21.7626	21.5265	20.5821	20.1099	20.1099	21.0543	22.2349	22.7071	22.4710	(38)
Heat transfer coeff	54.6914	54.6914	54.2192	52.8026	52.5665	51.6220	51.1498	51.1498	52.0942	53.2748	53.7470	53.5109	(39)
Average = Sum(39)m / 12 =												52.9600	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5969	0.5969	0.5917	0.5763	0.5737	0.5634	0.5582	0.5582	0.5685	0.5814	0.5866	0.5840	(40)
HLP (average)												0.5780	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6474	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	94.3355	92.9178	90.8520	86.8994	83.9824	80.7295	78.8805	80.9307	83.1782	86.6708	90.7083	93.9740	(42a)
Hot water usage for baths	29.6267	29.1867	28.5671	27.4247	26.5692	25.6207	25.1083	25.7236	26.3935	27.4085	28.5745	29.5266	(42b)
Hot water usage for other uses	41.7418	40.2239	38.7061	37.1882	35.6703	34.1524	34.1524	35.6703	37.1882	38.7061	40.2239	41.7418	(42c)
Average daily hot water use (litres/day)												152.3899	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	165.7040	162.3285	158.1251	151.5122	146.2220	140.5026	138.1413	142.3246	146.7598	152.7854	159.5067	165.2424	(44)
Energy conte	262.4347	231.1536	243.0325	207.4126	196.8429	172.7643	167.0699	176.2276	180.9695	207.3283	227.2466	258.7297	(45)
Energy content (annual)										Total = Sum(45)m =		2531.2122	
Distribution loss (46)m = 0.15 x (45)m	39.3652	34.6730	36.4549	31.1119	29.5264	25.9146	25.0605	26.4341	27.1454	31.0992	34.0870	38.8095	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(64)
										Total per year (kWh/year) = Sum(64)m =		2778.2442	(64)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

	104.0442	92.0189	97.5929	85.2079	82.2349	73.6873	72.3354	75.3803	76.4156	85.7213	91.8027	102.8123 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	28.0156	24.8832	20.2364	15.3202	11.4521	9.6683	10.4469	13.5793	18.2262	23.1423	27.0105	28.7942	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	361.2608	365.0096	355.5628	335.4518	310.0653	286.2055	270.2657	266.5170	275.9637	296.0747	321.4613	345.3210	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	(71)

Water heating gains (Table 5)

	139.8443	136.9329	131.1733	118.3443	110.5308	102.3435	97.2250	101.3176	106.1327	115.2168	127.5037	138.1885	(72)

Total internal gains

	635.6000	633.3049	613.4517	575.5956	538.5274	504.6966	484.4169	487.8932	506.8019	540.9131	582.4547	618.7830	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	15.7500	33.4622	0.6300	0.8270	0.7700	190.2894	(79)

Solar gains	190.2894	345.9491	494.6857	644.7453	714.8567	689.7496	673.2490	599.9794	530.8432	380.0563	234.2354	166.5382	(83)
Total gains	825.8894	979.2540	1108.1374	1220.3410	1253.3841	1194.4462	1157.6660	1087.8726	1037.6451	920.9694	816.6902	785.3213	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.7406	62.7406	63.2870	64.9849	65.2768	66.4711	67.0848	67.0848	65.8686	64.4089	63.8430	64.1247	
alpha	5.1827	5.1827	5.2191	5.3323	5.3518	5.4314	5.4723	5.4723	5.3912	5.2939	5.2562	5.2750	
util living area	0.8856	0.8077	0.7023	0.5546	0.4292	0.3365	0.2694	0.2913	0.4096	0.6281	0.8168	0.9011	(86)
MIT	20.5543	20.7324	20.8757	20.9671	20.9924	20.9984	20.9996	20.9994	20.9953	20.9482	20.7654	20.5210	(87)
Th 2	20.4328	20.4328	20.4375	20.4514	20.4537	20.4631	20.4677	20.4677	20.4584	20.4468	20.4421	20.4444	(88)
util rest of house	0.8737	0.7916	0.6827	0.5333	0.4070	0.3135	0.2459	0.2663	0.3831	0.6017	0.7986	0.8905	(89)
MIT 2	19.9204	20.1323	20.3026	20.4177	20.4466	20.4617	20.4675	20.4673	20.4544	20.3948	20.1836	19.8902	(90)
Living area fraction									fLA = Living area / (4) =			0.3233	(91)
MIT	20.1253	20.3262	20.4878	20.5953	20.6230	20.6352	20.6395	20.6393	20.6292	20.5737	20.3717	20.0941	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1253	20.3262	20.4878	20.5953	20.6230	20.6352	20.6395	20.6393	20.6292	20.5737	20.3717	20.0941	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8668	0.7885	0.6845	0.5389	0.4139	0.3209	0.2535	0.2744	0.3915	0.6078	0.7962	0.8833	(94)
Useful gains	715.8753	772.1300	758.4713	657.6777	518.8131	383.2731	293.4533	298.4963	406.2429	559.7734	650.2136	693.6692	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	887.3862	876.4983	807.2069	670.3450	521.6166	383.8203	293.5735	298.6799	407.8588	579.2935	740.1868	877.2620	(97)
Space heating kWh	127.6041	70.1355	36.2593	9.1205	2.0858	0.0000	0.0000	0.0000	0.0000	14.5230	64.7807	136.5930	(98a)
Space heating requirement - total per year (kWh/year)												461.1019	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	127.6041	70.1355	36.2593	9.1205	2.0858	0.0000	0.0000	0.0000	0.0000	14.5230	64.7807	136.5930	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												461.1019	
Space heating per m2											(98c) / (4) =	5.0322	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	127.6041	70.1355	36.2593	9.1205	2.0858	0.0000	0.0000	0.0000	0.0000	14.5230	64.7807	136.5930	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	127.6041	70.1355	36.2593	9.1205	2.0858	0.0000	0.0000	0.0000	0.0000	14.5230	64.7807	136.5930	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating
Water heating requirement

	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	18.9277	17.0960	18.9277	18.3171	18.9277	18.3171	18.9277	18.9277	18.3171	18.9277	18.3171	18.9277 (231)
Lighting	24.5219	19.6724	17.7128	12.9771	10.0239	8.1896	9.1441	11.8859	15.4386	20.2563	22.8795	25.2034 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-19.7117	-33.0439	-55.3130	-71.8302	-83.2504	-78.3437	-77.7327	-68.8212	-56.0902	-39.9181	-23.2317	-16.9672 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-3.7958	-9.9380	-23.8966	-43.3515	-60.1812	-59.6171	-59.7171	-46.4038	-31.3643	-15.4332	-5.6445	-2.9971 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year

Space heating fuel - main system 1	461.1019 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2778.2442 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	222.8585 (230a)
Total electricity for the above, kWh/year	222.8585 (231)
Electricity for lighting (calculated in Appendix L)	197.9055 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-986.5945 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2673.5156 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	461.1019	25.1600	116.0132	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2778.2442	25.1600	699.0062	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	222.8585	25.1600	56.0712	(249)
Energy for lighting	197.9055	25.1600	49.7930	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-624.2542	25.1600	-157.0624	
PV Unit electricity exported	-362.3403	5.8100	-21.0520	
Total			-178.1143	(252)
Total energy cost			742.7694	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	461.1019	0.1587	73.1700	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2778.2442	0.1413	392.6311	(264)
Space and water heating			465.8012	(265)
Pumps, fans and electric keep-hot	222.8585	0.1387	30.9132	(267)
Energy for lighting	197.9055	0.1443	28.5639	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-624.2542	0.1322	-82.5068	
PV Unit electricity exported	-362.3403	0.1227	-44.4634	
Total			-126.9702	(269)
Total CO2, kg/year			398.3081	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	461.1019	1.5873	731.9242	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2778.2442	1.5226	4230.1104	(278)
Space and water heating			4962.0346	(279)
Pumps, fans and electric keep-hot	222.8585	1.5128	337.1403	(281)
Energy for lighting	197.9055	1.5338	303.5541	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-624.2542	1.4883	-929.1044	
PV Unit electricity exported	-362.3403	0.4503	-163.1786	
Total			-1092.2830	(283)
Total Primary energy kWh/year			4510.4460	(286)

SAP 10 EPC IMPROVEMENTS

Unit 386 TH_Copy

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N	Solar water heating		Not applicable
U	Solar photovoltaic panels		Not applicable
V2	Wind turbine		Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 80
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£921	£921	£0
Space heating	£172	£172	£0
Water heating	£699	£699	£0
Lighting	£50	£50	£0
Generated (PV)	-£178	-£178	£0
Total cost of fuels	£743	£743	£0
Total cost of uses	£743	£743	£0
Delivered energy	29 kWh/m²	29 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	4 kg/m²	4 kg/m²	0 kg/m²
Primary energy	49 kWh/m²	49 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.4600 (1b)	x	2.6700 (2b)	=	108.0282	(1b) - (3b)
First floor	51.1700 (1c)	x	2.7000 (2c)	=	138.1590	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.1872	(5)

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2. Ventilation rate
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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.7500	1.2357	19.4629			(27)
Heatloss Floor 1			40.4600	0.1200	4.8552	75.0000	3034.5000	(28a)
External Wall 1	34.1400	15.7500	18.3900	0.1400	2.5746	14.0000	257.4600	(29a)
Total net area of external elements Aum(A, m2)			74.6000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.8927			(33)
Party Wall 1			93.4200	0.0000	0.0000	20.0000	1868.4000	(32)
Wall to corridor			36.1400	0.0000	0.0000	20.0000	722.8000	(32)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			223.5600			9.0000	2012.0400	(32c)
Internal Floor 1			51.1700			0.0000	0.0000	(32d)
Internal Ceiling 1			40.4600			9.0000	364.1400	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12352.9400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 134.8133 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	6.7900	0.0500	0.3395
E4 Jamb	18.5500	0.0500	0.9275
E5 Ground floor (normal)	5.9500	0.1600	0.9520
E18 Party wall between dwellings	6.0700	0.0600	0.3642
P1 Party wall - Ground floor	19.5500	0.0800	1.5640
E6 Intermediate floor within a dwelling	5.9500	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.1472 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 31.0399 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.4154	23.1793	22.9432	21.7626	21.5265	20.3460	20.3460	20.1099	20.8182	21.5265	21.9987	22.4710	(38)
Heat transfer coeff	54.4553	54.2192	53.9831	52.8026	52.5665	51.3859	51.3859	51.1498	51.8581	52.5665	53.0387	53.5109	(39)
Average = Sum(39)m / 12 =												52.7435	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5943	0.5917	0.5891	0.5763	0.5737	0.5608	0.5608	0.5582	0.5660	0.5737	0.5788	0.5840	(40)
HLP (average)												0.5756	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6474 (42)
Hot water usage for mixer showers

94.3355	92.9178	90.8520	86.8994	83.9824	80.7295	78.8805	80.9307	83.1782	86.6708	90.7083	93.9740	(42a)

Hot water usage for baths

29.6267	29.1867	28.5671	27.4247	26.5692	25.6207	25.1083	25.7236	26.3935	27.4085	28.5745	29.5266	(42b)

Hot water usage for other uses

41.7418	40.2239	38.7061	37.1882	35.6703	34.1524	34.1524	35.6703	37.1882	38.7061	40.2239	41.7418	(42c)

Average daily hot water use (litres/day) 152.3899 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	165.7040	162.3285	158.1251	151.5122	146.2220	140.5026	138.1413	142.3246	146.7598	152.7854	159.5067	165.2424	(44)
Energy conte	262.4347	231.1536	243.0325	207.4126	196.8429	172.7643	167.0699	176.2276	180.9695	207.3283	227.2466	258.7297	(45)
Energy content (annual)										Total = Sum(45)m =		2531.2122	
Distribution loss (46)m = 0.15 x (45)m	39.3652	34.6730	36.4549	31.1119	29.5264	25.9146	25.0605	26.4341	27.1454	31.0992	34.0870	38.8095	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(64)

Total per year (kWh/year) = Sum(64)m = 2778.2442 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

104.0442	92.0189	97.5929	85.2079	82.2349	73.6873	72.3354	75.3803	76.4156	85.7213	91.8027	102.8123	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.0156	24.8832	20.2364	15.3202	11.4521	9.6683	10.4469	13.5793	18.2262	23.1423	27.0105	28.7942	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	361.2608	365.0096	355.5628	335.4518	310.0653	286.2055	270.2657	266.5170	275.9637	296.0747	321.4613	345.3210	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	(71)
Water heating gains (Table 5)													
	139.8443	136.9329	131.1733	118.3443	110.5308	102.3435	97.2250	101.3176	106.1327	115.2168	127.5037	138.1885	(72)
Total internal gains													
	635.6000	633.3049	613.4517	575.5956	538.5274	504.6966	484.4169	487.8932	506.8019	540.9131	582.4547	618.7830	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	15.7500	36.7938	0.6300	0.8270	0.7700	209.2353	(79)

Solar gains	209.2353	356.4051	487.6489	604.2207	676.7775	671.8834	647.7673	593.6367	528.0207	393.9035	250.6156	179.0618	(83)
Total gains	844.8352	989.7099	1101.1007	1179.8163	1215.3049	1176.5800	1132.1842	1081.5299	1034.8226	934.8166	833.0703	797.8448	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.0126	63.2870	63.5638	64.9849	65.2768	66.7765	66.7765	67.0848	66.1684	65.2768	64.6957	64.1247	
alpha	5.2008	5.2191	5.2376	5.3323	5.3518	5.4518	5.4518	5.4723	5.4112	5.3518	5.3130	5.2750	
util living area	0.8680	0.7823	0.6718	0.5319	0.4004	0.2793	0.1997	0.2175	0.3451	0.5706	0.7861	0.8863	(86)
MIT	20.6145	20.7838	20.9057	20.9750	20.9951	20.9995	20.9999	20.9999	20.9983	20.9707	20.8187	20.5786	(87)
Th 2	20.4351	20.4375	20.4398	20.4514	20.4537	20.4654	20.4654	20.4677	20.4607	20.4537	20.4491	20.4444	(88)
util rest of house	0.8547	0.7649	0.6509	0.5095	0.3773	0.2561	0.1754	0.1924	0.3183	0.5434	0.7661	0.8744	(89)
MIT 2	19.9955	20.1973	20.3391	20.4263	20.4493	20.4650	20.4654	20.4677	20.4594	20.4254	20.2521	19.9607	(90)
Living area fraction										fLA = Living area / (4) =		0.3233	(91)
MIT	20.1956	20.3869	20.5223	20.6037	20.6257	20.6378	20.6382	20.6397	20.6336	20.6016	20.4353	20.1604	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1956	20.3869	20.5223	20.6037	20.6257	20.6378	20.6382	20.6397	20.6336	20.6016	20.4353	20.1604	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8487	0.7632	0.6541	0.5157	0.3846	0.2636	0.1833	0.2005	0.3269	0.5508	0.7656	0.8678	(94)
Useful gains	717.0448	755.3875	720.1823	608.4668	467.4204	310.0983	207.4891	216.8351	338.2800	514.8977	637.8073	692.3806	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	865.6011	839.6879	756.9667	617.9850	469.1922	310.2579	207.5054	216.8614	338.8222	525.7509	707.2840	854.0572	(97)
Space heating kWh	110.5259	56.6499	27.3675	6.8531	1.3182	0.0000	0.0000	0.0000	0.0000	8.0748	50.0233	120.2874	(98a)
Space heating requirement - total per year (kWh/year)												381.1002	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	110.5259	56.6499	27.3675	6.8531	1.3182	0.0000	0.0000	0.0000	0.0000	8.0748	50.0233	120.2874	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												381.1002	
Space heating per m2											(98c) / (4) =	4.1591	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	110.5259	56.6499	27.3675	6.8531	1.3182	0.0000	0.0000	0.0000	0.0000	8.0748	50.0233	120.2874	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	110.5259	56.6499	27.3675	6.8531	1.3182	0.0000	0.0000	0.0000	0.0000	8.0748	50.0233	120.2874	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	18.9277	17.0960	18.9277	18.3171	18.9277	18.3171	18.9277	18.9277	18.3171	18.9277	18.3171	18.9277	(231)
Lighting	24.5219	19.6724	17.7128	12.9771	10.0239	8.1896	9.1441	11.8859	15.4386	20.2563	22.8795	25.2034	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-21.7229	-34.2517	-55.1813	-68.9038	-80.4545	-77.2515	-76.0210	-68.8008	-56.4551	-41.5599	-24.9218	-18.3337	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													

(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-4.5055	-10.7118	-24.0554	-40.3041	-56.4573	-58.0168	-57.1913	-46.3778	-31.7365	-16.6933	-6.4371	-3.4409	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	381.1002	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2778.2442	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	222.8585	(230a)
Total electricity for the above, kWh/year	222.8585	(231)
Electricity for lighting (calculated in Appendix L)	197.9055	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-979.7858	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2600.3226	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	381.1002	16.4900	62.8434	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2778.2442	16.4900	458.1325	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	222.8585	16.4900	36.7494	(249)
Energy for lighting	197.9055	16.4900	32.6346	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-623.8580	16.4900	-102.8742	
PV Unit electricity exported	-355.9278	5.5900	-19.8964	
Total			-122.7705	(252)
Total energy cost			467.5893	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2320	(257)
SAP value	80.0288	
SAP rating (Section 12)	80	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	381.1002	0.1592	60.6795	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2778.2442	0.1413	392.6311	(264)
Space and water heating			453.3106	(265)
Pumps, fans and electric keep-hot	222.8585	0.1387	30.9132	(267)
Energy for lighting	197.9055	0.1443	28.5639	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-623.8580	0.1325	-82.6425	
PV Unit electricity exported	-355.9278	0.1232	-43.8625	
Total			-126.5050	(269)
Total CO2, kg/year			386.2827	(272)
CO2 emissions per m2			4.2200	(273)
EI value			96.2115	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

Area	Storey height	Volume

	(m2)		(m)		(m3)	
Ground floor	40.4600 (1b)	x	2.6700 (2b)	=	108.0282	(1b) - (3b)
First floor	51.1700 (1c)	x	2.7000 (2c)	=	138.1590	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.1872	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.7500	1.2357	19.4629			(27)
Heatloss Floor 1			40.4600	0.1200	4.8552	75.0000	3034.5000	(28a)
External Wall 1	34.1400	15.7500	18.3900	0.1400	2.5746	14.0000	257.4600	(29a)
Total net area of external elements Aum(A, m2)			74.6000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.8927			(33)
Party Wall 1			93.4200	0.0000	0.0000	20.0000	1868.4000	(32)
Wall to corridor			36.1400	0.0000	0.0000	20.0000	722.8000	(32)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			223.5600			9.0000	2012.0400	(32c)
Internal Floor 1			51.1700			0.0000	0.0000	(32d)
Internal Ceiling 1			40.4600			9.0000	364.1400	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12352.9400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		134.8133 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	6.7900	0.0500	0.3395
E4 Jamb	18.5500	0.0500	0.9275
E5 Ground floor (normal)	5.9500	0.1600	0.9520
E18 Party wall between dwellings	6.0700	0.0600	0.3642
P1 Party wall - Ground floor	19.5500	0.0800	1.5640
E6 Intermediate floor within a dwelling	5.9500	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.1472 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	31.0399 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.6515	23.6515	23.1793	21.7626	21.5265	20.5821	20.1099	20.1099	21.0543	22.2349	22.7071	22.4710	(38)
Heat transfer coeff	54.6914	54.6914	54.2192	52.8026	52.5665	51.6220	51.1498	51.1498	52.0942	53.2748	53.7470	53.5109	(39)
Average = Sum(39)m / 12 =												52.9600	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5969	0.5969	0.5917	0.5763	0.5737	0.5634	0.5582	0.5582	0.5685	0.5814	0.5866	0.5840	(40)
HLP (average)												0.5780	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6474 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
94.3355	92.9178	90.8520	86.8994	83.9824	80.7295	78.8805	80.9307	83.1782	86.6708	90.7083	93.9740	(42a)

Hot water usage for baths

29.6267	29.1867	28.5671	27.4247	26.5692	25.6207	25.1083	25.7236	26.3935	27.4085	28.5745	29.5266	(42b)

Hot water usage for other uses

41.7418	40.2239	38.7061	37.1882	35.6703	34.1524	34.1524	35.6703	37.1882	38.7061	40.2239	41.7418	(42c)

Average daily hot water use (litres/day)	152.3899 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

	165.7040	162.3285	158.1251	151.5122	146.2220	140.5026	138.1413	142.3246	146.7598	152.7854	159.5067	165.2424	(44)
Energy conte	262.4347	231.1536	243.0325	207.4126	196.8429	172.7643	167.0699	176.2276	180.9695	207.3283	227.2466	258.7297	(45)
Energy content (annual)											Total = Sum(45)m =	2531.2122	
Distribution loss (46)m = 0.15 x (45)m													
	39.3652	34.6730	36.4549	31.1119	29.5264	25.9146	25.0605	26.4341	27.1454	31.0992	34.0870	38.8095	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(64)
										Total per year (kWh/year) = Sum(64)m =		2778.2442	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	104.0442	92.0189	97.5929	85.2079	82.2349	73.6873	72.3354	75.3803	76.4156	85.7213	91.8027	102.8123	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	158.8428	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.0156	24.8832	20.2364	15.3202	11.4521	9.6683	10.4469	13.5793	18.2262	23.1423	27.0105	28.7942	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	361.2608	365.0096	355.5628	335.4518	310.0653	286.2055	270.2657	266.5170	275.9637	296.0747	321.4613	345.3210	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	53.5317	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	-105.8952	(71)
Water heating gains (Table 5)													
	139.8443	136.9329	131.1733	118.3443	110.5308	102.3435	97.2250	101.3176	106.1327	115.2168	127.5037	138.1885	(72)
Total internal gains													
	635.6000	633.3049	613.4517	575.5956	538.5274	504.6966	484.4169	487.8932	506.8019	540.9131	582.4547	618.7830	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	15.7500	33.4622	0.6300	0.8270	0.7700	190.2894	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	190.2894	345.9491	494.6857	644.7453	714.8567	689.7496	673.2490	599.9794	530.8432	380.0563	234.2354	166.5382	(83)
Total gains	825.8894	979.2540	1108.1374	1220.3410	1253.3841	1194.4462	1157.6660	1087.8726	1037.6451	920.9694	816.6902	785.3213	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.7406	62.7406	63.2870	64.9849	65.2768	66.4711	67.0848	67.0848	65.8686	64.4089	63.8430	64.1247	
alpha	5.1827	5.1827	5.2191	5.3323	5.3518	5.4314	5.4723	5.4723	5.3912	5.2939	5.2562	5.2750	
util living area													
	0.8856	0.8077	0.7023	0.5546	0.4292	0.3365	0.2694	0.2913	0.4096	0.6281	0.8168	0.9011	(86)
MIT	20.5543	20.7324	20.8757	20.9671	20.9924	20.9984	20.9996	20.9994	20.9953	20.9482	20.7654	20.5210	(87)
Th 2	20.4328	20.4328	20.4375	20.4514	20.4537	20.4631	20.4677	20.4677	20.4584	20.4468	20.4421	20.4444	(88)
util rest of house													
	0.8737	0.7916	0.6827	0.5333	0.4070	0.3135	0.2459	0.2663	0.3831	0.6017	0.7986	0.8905	(89)
MIT 2	19.9204	20.1323	20.3026	20.4177	20.4466	20.4617	20.4675	20.4673	20.4544	20.3948	20.1836	19.8902	(90)
Living area fraction									fLA = Living area / (4) =			0.3233	(91)
MIT	20.1253	20.3262	20.4878	20.5953	20.6230	20.6352	20.6395	20.6393	20.6292	20.5737	20.3717	20.0941	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1253	20.3262	20.4878	20.5953	20.6230	20.6352	20.6395	20.6393	20.6292	20.5737	20.3717	20.0941	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8668	0.7885	0.6845	0.5389	0.4139	0.3209	0.2535	0.2744	0.3915	0.6078	0.7962	0.8833	(94)
Useful gains	715.8753	772.1300	758.4713	657.6777	518.8131	383.2731	293.4533	298.4963	406.2429	559.7734	650.2136	693.6692	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	887.3862	876.4983	807.2069	670.3450	521.6166	383.8203	293.5735	298.6799	407.8588	579.2935	740.1868	877.2620	(97)
Space heating kWh													
	127.6041	70.1355	36.2593	9.1205	2.0858	0.0000	0.0000	0.0000	0.0000	14.5230	64.7807	136.5930	(98a)
Space heating requirement - total per year (kWh/year)												461.1019	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	127.6041	70.1355	36.2593	9.1205	2.0858	0.0000	0.0000	0.0000	0.0000	14.5230	64.7807	136.5930	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 461.1019
Space heating per m2 (98c) / (4) = 5.0322 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 100.0000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	127.6041	70.1355	36.2593	9.1205	2.0858	0.0000	0.0000	0.0000	0.0000	14.5230	64.7807	136.5930	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	127.6041	70.1355	36.2593	9.1205	2.0858	0.0000	0.0000	0.0000	0.0000	14.5230	64.7807	136.5930	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	283.4155	250.1040	264.0133	227.7166	217.8237	193.0683	188.0507	197.2084	201.2735	228.3091	247.5506	279.7105	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	18.9277	17.0960	18.9277	18.3171	18.9277	18.3171	18.9277	18.9277	18.3171	18.9277	18.3171	18.9277	(231)
Lighting	24.5219	19.6724	17.7128	12.9771	10.0239	8.1896	9.1441	11.8859	15.4386	20.2563	22.8795	25.2034	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-19.7117	-33.0439	-55.3130	-71.8302	-83.2504	-78.3437	-77.7327	-68.8212	-56.0902	-39.9181	-23.2317	-16.9672	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.7958	-9.9380	-23.8966	-43.3515	-60.1812	-59.6171	-59.7171	-46.4038	-31.3643	-15.4332	-5.6445	-2.9971	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year
Space heating fuel - main system 1 461.1019 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 100.0000
Water heating fuel used 2778.2442 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)
mechanical ventilation fans (SFP = 0.7420) 222.8585 (230a)
Total electricity for the above, kWh/year 222.8585 (231)
Electricity for lighting (calculated in Appendix L) 197.9055 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation -986.5945 (233)
Wind generation 0.0000 (234)
Hydro-electric generation (Appendix N) 0.0000 (235a)
Electricity generated - Micro CHP (Appendix N) 0.0000 (235)
Appendix Q - special features
Energy saved or generated -0.0000 (236)
Energy used 0.0000 (237)
Total delivered energy for all uses 2673.5156 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	461.1019	25.1600	116.0132	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2778.2442	25.1600	699.0062	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	222.8585	25.1600	56.0712	(249)
Energy for lighting	197.9055	25.1600	49.7930	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-624.2542	25.1600	-157.0624	
PV Unit electricity exported	-362.3403	5.8100	-21.0520	
Total			-178.1143	(252)
Total energy cost			742.7694	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	461.1019	0.1587	73.1700	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2778.2442	0.1413	392.6311	(264)
Space and water heating			465.8012	(265)

Pumps, fans and electric keep-hot	222.8585	0.1387	30.9132	(267)
Energy for lighting	197.9055	0.1443	28.5639	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-624.2542	0.1322	-82.5068	
PV Unit electricity exported	-362.3403	0.1227	-44.4634	
Total			-126.9702	(269)
Total CO2, kg/year			398.3081	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	461.1019	1.5873	731.9242	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2778.2442	1.5226	4230.1104	(278)
Space and water heating			4962.0346	(279)
Pumps, fans and electric keep-hot	222.8585	1.5128	337.1403	(281)
Energy for lighting	197.9055	1.5338	303.5541	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-624.2542	1.4883	-929.1044	
PV Unit electricity exported	-362.3403	0.4503	-163.1786	
Total			-1092.2830	(283)
Total Primary energy kWh/year			4510.4460	(286)

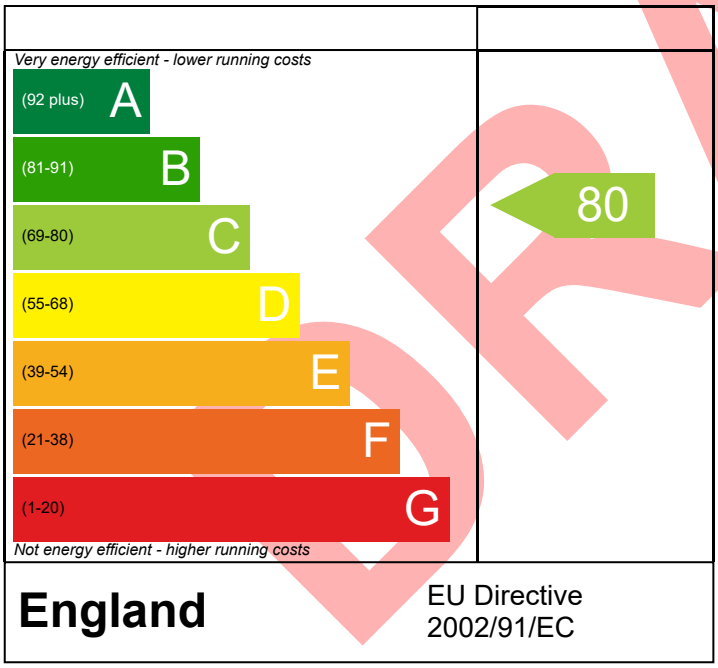
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	91.63 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

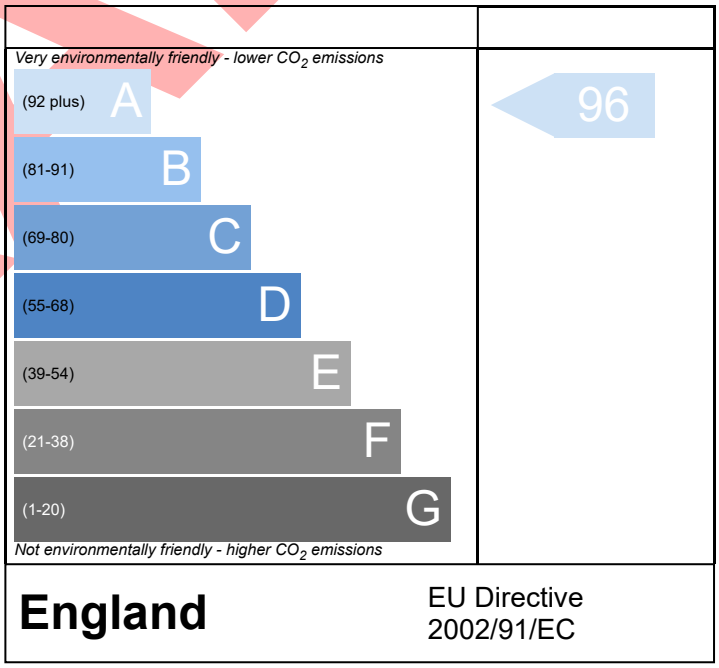
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:16

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	67 m^2
Site Reference	Unit 387 TH GF_Copy	Plot Reference	Unit 387 TH_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.1 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	5.07 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*60.05 kWh$_{PE}$/m^2*	
Dwelling primary energy	57.02 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*19.7 kWh/m^2*	
Dwelling fabric energy efficiency	18.2 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.12	Heatloss Floor 1 (0.12)	OK
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	11.93	0.14 **(!)**
Party wall: Party Wall (1)	104.64	0 **(!)**
Party wall: Party Wall (2)	11.2	0 **(!)**
Ground floor: Heatloss Floor 1, Heatloss Floor 1	28	0.12

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	9.82	South West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.16	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.08	
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0 **(!)**	
Party wall	P2: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.87 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 387 TH GF_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 387 TH_Copy	**Prop Type Ref**	Unit 387 TH GF
Property			

SAP Rating	79 C	**DER**	5.07	**TER**	11.10
Environmental	96 A	**% DER < TER**			54.32
CO_2 Emissions (t/year)	0.34	**DFEE**	18.22	**TFEE**	19.71
Compliance Check	See BREL	**% DFEE < TFEE**			7.57
% DPER < TPER	5.04	**DPER**	57.02	**TPER**	60.05

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	28.0000 (1b)	x	2.6700 (2b)	=	74.7600	(1b) - (3b)
First floor	38.9800 (1c)	x	2.7000 (2c)	=	105.2460	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	180.0060	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			9.8200	1.2357	12.1350			(27)
Heatloss Floor 1			28.0000	0.1200	3.3600	75.0000	2100.0000	(28a)
External Wall 1	21.7500	9.8200	11.9300	0.1400	1.6702	14.0000	167.0200	(29a)
Total net area of external elements Aum(A, m2)			49.7500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		17.1652			(33)
Party Wall 1			104.6400	0.0000	0.0000	20.0000	2092.8000	(32)
Wall to corridor			11.2000	0.0000	0.0000	20.0000	224.0000	(32)
Party Ceiling 1			38.9800			80.0000	3118.4000	(32b)
Internal Wall 1			120.5500			9.0000	1084.9500	(32c)
Internal Floor 1			38.9800			0.0000	0.0000	(32d)
Internal Ceiling 1			28.0000			9.0000	252.0000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 9039.1700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	134.9533 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	4.2300	0.0500	0.2115
E4 Jamb	13.9100	0.0500	0.6955
E5 Ground floor (normal)	4.1100	0.1600	0.6576
E18 Party wall between dwellings	12.1500	0.0600	0.7290
P1 Party wall - Ground floor	17.7100	0.0800	1.4168
E6 Intermediate floor within a dwelling	3.0300	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	26.2300	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.7104 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 20.8756 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	17.1208	16.9481	16.7755	15.9123	15.7397	14.8765	14.8765	14.7038	15.2218	15.7397	16.0849	16.4302	(38)
Heat transfer coeff	37.9963	37.8237	37.6511	36.7879	36.6152	35.7521	35.7521	35.5794	36.0973	36.6152	36.9605	37.3058	(39)

Average = Sum(39)m / 12 = 36.7447

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5673	0.5647	0.5621	0.5492	0.5467	0.5338	0.5338	0.5312	0.5389	0.5467	0.5518	0.5570	(40)
HLP (average)												0.5486	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1706 (42)

Hot water usage for mixer showers												
	83.3443	82.0918	80.2666	76.7746	74.1975	71.3236	69.6900	71.5014	73.4869	76.5726	80.1397	83.0250 (42a)
Hot water usage for baths												
	26.1892	25.8003	25.2526	24.2427	23.4865	22.6480	22.1951	22.7390	23.3311	24.2284	25.2591	26.1007 (42b)
Hot water usage for other uses												
	36.8595	35.5191	34.1788	32.8384	31.4981	30.1577	30.1577	31.4981	32.8384	34.1788	35.5191	36.8595 (42c)

Average daily hot water use (litres/day) 134.6308 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	146.3930	143.4112	139.6980	133.8557	129.1821	124.1293	122.0428	125.7384	129.6565	134.9798	140.9179	145.9851	(44)
Energy conte	231.8507	204.2156	214.7106	183.2417	173.9039	152.6315	147.6002	155.6904	159.8794	183.1663	200.7634	228.5774	(45)
Energy content (annual)										Total = Sum(45)m =		2236.2313	
Distribution loss (46)m = 0.15 x (45)m													
	34.7776	30.6323	32.2066	27.4863	26.0856	22.8947	22.1400	23.3536	23.9819	27.4749	30.1145	34.2866	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808 (56)
If cylinder contains dedicated solar storage												
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	252.8315	223.1660	235.6914	203.5457	194.8847	172.9355	168.5810	176.6712	180.1834	204.1471	221.0674	249.5582 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	252.8315	223.1660	235.6914	203.5457	194.8847	172.9355	168.5810	176.6712	180.1834	204.1471	221.0674	249.5582 (64)
										Total per year (kWh/year) = Sum(64)m =		2483.2633 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
					Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =							0.0000 (64a)
Heat gains from water heating, kWh/month												
	93.8750	83.0620	88.1759	77.1711	74.6077	66.9932	65.8617	68.5517	69.4031	77.6874	82.9970	92.7866 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	130.2381	130.2381	130.2381	130.2381	130.2381	130.2381	130.2381	130.2381	130.2381	130.2381	130.2381	130.2381	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.4997	19.9840	16.2521	12.3039	9.1973	7.7647	8.3901	10.9057	14.6377	18.5859	21.6925	23.1250	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	283.8038	286.7488	279.3275	263.5284	243.5850	224.8409	212.3187	209.3737	216.7950	232.5941	252.5376	271.2816	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.1944	50.1944	50.1944	50.1944	50.1944	50.1944	50.1944	50.1944	50.1944	50.1944	50.1944	50.1944	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-86.8254	-86.8254	-86.8254	-86.8254	-86.8254	-86.8254	-86.8254	-86.8254	-86.8254	-86.8254	-86.8254	-86.8254	(71)
Water heating gains (Table 5)	126.1761	123.6042	118.5160	107.1821	100.2791	93.0461	88.5238	92.1394	96.3932	104.4186	115.2737	124.7132	(72)
Total internal gains	526.0867	523.9441	507.7027	476.6215	446.6685	419.2588	402.8398	406.0260	421.4330	449.2057	483.1108	512.7270	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	9.8200	36.7938	0.6300	0.8270	0.7700	130.4565	(79)

Solar gains	130.4565	222.2157	304.0452	376.7268	421.9654	418.9140	403.8778	370.1278	329.2167	245.5957	156.2569	111.6436 (83)
Total gains	656.5432	746.1598	811.7480	853.3483	868.6339	838.1728	806.7176	776.1538	750.6497	694.8014	639.3676	624.3706 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	66.0822	66.3838	66.6882	68.2529	68.5747	70.2304	70.2304	70.5711	69.5586	68.5747	67.9341	67.3054	
alpha	5.4055	5.4256	5.4459	5.5502	5.5716	5.6820	5.6820	5.7047	5.6372	5.5716	5.5289	5.4870	
util living area	0.8291	0.7478	0.6450	0.5148	0.3907	0.2729	0.1950	0.2108	0.3314	0.5392	0.7416	0.8474	(86)
MIT	20.7278	20.8459	20.9324	20.9823	20.9966	20.9997	21.0000	20.9999	20.9990	20.9813	20.8798	20.7042	(87)
Th 2	20.4595	20.4619	20.4642	20.4759	20.4782	20.4900	20.4900	20.4923	20.4853	20.4782	20.4736	20.4689	(88)
util rest of house	0.8143	0.7300	0.6249	0.4937	0.3691	0.2512	0.1724	0.1876	0.3068	0.5139	0.7211	0.8336	(89)
MIT 2	20.1520	20.2917	20.3923	20.4582	20.4751	20.4897	20.4899	20.4923	20.4845	20.4602	20.3442	20.1328	(90)
Living area fraction										fLA = Living area / (4) =		0.2950	(91)
MIT	20.3218	20.4552	20.5517	20.6128	20.6290	20.6402	20.6404	20.6421	20.6363	20.6139	20.5022	20.3014	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3218	20.4552	20.5517	20.6128	20.6290	20.6402	20.6404	20.6421	20.6363	20.6139	20.5022	20.3014	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8103	0.7298	0.6282	0.4992	0.3754	0.2576	0.1791	0.1944	0.3140	0.5205	0.7223	0.8290	(94)
Useful gains	532.0170	544.5610	509.9469	426.0253	326.0541	215.8765	144.4463	150.9191	235.7041	361.6691	461.7995	517.6164	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	608.7712	588.3554	529.0598	430.8884	326.9364	215.9486	144.4530	150.9298	235.9416	366.6621	495.3511	600.6743	(97)
Space heating kWh	57.1051	29.4298	14.2200	3.5014	0.6565	0.0000	0.0000	0.0000	0.0000	3.7148	24.1572	61.7951	(98a)
Space heating requirement - total per year (kWh/year)												194.5798	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	57.1051	29.4298	14.2200	3.5014	0.6565	0.0000	0.0000	0.0000	0.0000	3.7148	24.1572	61.7951	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												194.5798	
Space heating per m2											(98c) / (4) =	2.9050	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 100.0000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	57.1051	29.4298	14.2200	3.5014	0.6565	0.0000	0.0000	0.0000	0.0000	3.7148	24.1572	61.7951	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	57.1051	29.4298	14.2200	3.5014	0.6565	0.0000	0.0000	0.0000	0.0000	3.7148	24.1572	61.7951	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	252.8315	223.1660	235.6914	203.5457	194.8847	172.9355	168.5810	176.6712	180.1834	204.1471	221.0674	249.5582	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	252.8315	223.1660	235.6914	203.5457	194.8847	172.9355	168.5810	176.6712	180.1834	204.1471	221.0674	249.5582	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.8395	12.5002	13.8395	13.3930	13.8395	13.3930	13.8395	13.8395	13.3930	13.8395	13.3930	13.8395	(231)
Lighting	19.6938	15.7991	14.2254	10.4221	8.0503	6.5772	7.3438	9.5457	12.3990	16.2681	18.3748	20.2412	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.9966	-25.3825	-41.2114	-51.8878	-60.9356	-58.6429	-57.7145	-52.0890	-42.5409	-31.0515	-18.4313	-13.4855	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.1789	-7.4900	-16.7180	-27.9532	-39.1596	-40.2508	-39.6760	-32.1173	-21.9353	-11.5369	-4.4949	-2.4337	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 194.5798 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 100.0000

Water heating fuel used 2483.2633 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)

mechanical ventilation fans (SFP = 0.7420) 162.9486 (230a)

Total electricity for the above, kWh/year 162.9486 (231)

Electricity for lighting (calculated in Appendix L) 158.9404 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	-716.3140	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2283.4182	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	194.5798	16.4900	32.0862	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2483.2633	16.4900	409.4901	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	162.9486	16.4900	26.8702	(249)
Energy for lighting	158.9404	16.4900	26.2093	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-469.3694	16.4900	-77.3990	
PV Unit electricity exported	-246.9445	5.5900	-13.8042	
Total			-91.2032	(252)
Total energy cost			403.4526	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2970	(257)
SAP value		78.9749	
SAP rating (Section 12)		79	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	194.5798	0.1593	31.0054	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2483.2633	0.1413	350.8682	(264)
Space and water heating			381.8736	(265)
Pumps, fans and electric keep-hot	162.9486	0.1387	22.6030	(267)
Energy for lighting	158.9404	0.1443	22.9400	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-469.3694	0.1323	-62.1091	
PV Unit electricity exported	-246.9445	0.1233	-30.4480	
Total			-92.5571	(269)
Total CO2, kg/year			334.8596	(272)
CO2 emissions per m2			5.0000	(273)
EI value			95.9929	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	28.0000	(1b)	x 2.6700	(2b) =	74.7600	(1b) - (3b)
First floor	38.9800	(1c)	x 2.7000	(2c) =	105.2460	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		180.0060	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	

Measured/design AP50	3.0000	(17)
Infiltration rate	0.1500	(18)
Number of sides sheltered	3	(19)
Shelter factor (20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			9.8200	1.2357	12.1350			(27)
Heatloss Floor 1			28.0000	0.1200	3.3600	75.0000	2100.0000	(28a)
External Wall 1	21.7500	9.8200	11.9300	0.1400	1.6702	14.0000	167.0200	(29a)
Total net area of external elements Aum(A, m2)			49.7500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		17.1652			(33)
Party Wall 1			104.6400	0.0000	0.0000	20.0000	2092.8000	(32)
Wall to corridor			11.2000	0.0000	0.0000	20.0000	224.0000	(32)
Party Ceiling 1			38.9800			80.0000	3118.4000	(32b)
Internal Wall 1			120.5500			9.0000	1084.9500	(32c)
Internal Floor 1			38.9800			0.0000	0.0000	(32d)
Internal Ceiling 1			28.0000			9.0000	252.0000	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) =	9039.1700	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	134.9533	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	4.2300	0.0500	0.2115
E4 Jamb	13.9100	0.0500	0.6955
E5 Ground floor (normal)	4.1100	0.1600	0.6576
E18 Party wall between dwellings	12.1500	0.0600	0.7290
P1 Party wall - Ground floor	17.7100	0.0800	1.4168
E6 Intermediate floor within a dwelling	3.0300	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	26.2300	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	3.7104	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	20.8756	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	17.2934	17.2934	16.9481	15.9123	15.7397	15.0491	14.7038	14.7038	15.3944	16.2576	16.6029	16.4302	(38)
Heat transfer coeff	38.1690	38.1690	37.8237	36.7879	36.6152	35.9247	35.5794	35.5794	36.2700	37.1332	37.4784	37.3058	(39)
Average = Sum(39)m / 12 =												36.9030	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5699	0.5699	0.5647	0.5492	0.5467	0.5363	0.5312	0.5312	0.5415	0.5544	0.5595	0.5570	(40)
HLP (average)												0.5510	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1706	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	83.3443	82.0918	80.2666	76.7746	74.1975	71.3236	69.6900	71.5014	73.4869	76.5726	80.1397	83.0250	(42a)
Hot water usage for baths	26.1892	25.8003	25.2526	24.2427	23.4865	22.6480	22.1951	22.7390	23.3311	24.2284	25.2591	26.1007	(42b)
Hot water usage for other uses	36.8595	35.5191	34.1788	32.8384	31.4981	30.1577	30.1577	31.4981	32.8384	34.1788	35.5191	36.8595	(42c)
Average daily hot water use (litres/day)												134.6308	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	146.3930	143.4112	139.6980	133.8557	129.1821	124.1293	122.0428	125.7384	129.6565	134.9798	140.9179	145.9851	(44)
Energy conte	231.8507	204.2156	214.7106	183.2417	173.9039	152.6315	147.6002	155.6904	159.8794	183.1663	200.7634	228.5774	(45)
Energy content (annual)										Total = Sum(45)m =		2236.2313	
Distribution loss (46)m = 0.15 x (45)m	34.7776	30.6323	32.2066	27.4863	26.0856	22.8947	22.1400	23.3536	23.9819	27.4749	30.1145	34.2866	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	252.8315	223.1660	235.6914	203.5457	194.8847	172.9355	168.5810	176.6712	180.1834	204.1471	221.0674	249.5582	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	252.8315	223.1660	235.6914	203.5457	194.8847	172.9355	168.5810	176.6712	180.1834	204.1471	221.0674	249.5582	(64)
Total per year (kWh/year) = Sum(64)m =												2483.2633	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)

Heat gains from water heating, kWh/month
93.8750 83.0620 88.1759 77.1711 74.6077 66.9932 65.8617 68.5517 69.4031 77.6874 82.9970 92.7866 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	130.2381	130.2381	130.2381	130.2381	130.2381	130.2381	130.2381	130.2381	130.2381	130.2381	130.2381	130.2381	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	22.4997	19.9840	16.2521	12.3039	9.1973	7.7647	8.3901	10.9057	14.6377	18.5859	21.6925	23.1250	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	283.8038	286.7488	279.3275	263.5284	243.5850	224.8409	212.3187	209.3737	216.7950	232.5941	252.5376	271.2816	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	50.1944	50.1944	50.1944	50.1944	50.1944	50.1944	50.1944	50.1944	50.1944	50.1944	50.1944	50.1944	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-86.8254	-86.8254	-86.8254	-86.8254	-86.8254	-86.8254	-86.8254	-86.8254	-86.8254	-86.8254	-86.8254	-86.8254	(71)

Water heating gains (Table 5)

	126.1761	123.6042	118.5160	107.1821	100.2791	93.0461	88.5238	92.1394	96.3932	104.4186	115.2737	124.7132	(72)

Total internal gains

	526.0867	523.9441	507.7027	476.6215	446.6685	419.2588	402.8398	406.0260	421.4330	449.2057	483.1108	512.7270	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	9.8200	33.4622	0.6300	0.8270	0.7700	118.6440	(79)

Solar gains	118.6440	215.6965	308.4326	401.9936	445.7075	430.0534	419.7654	374.0824	330.9765	236.9621	146.0439	103.8353	(83)
Total gains	644.7306	739.6407	816.1353	878.6151	892.3760	849.3123	822.6052	780.1084	752.4096	686.1678	629.1547	616.5622	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	65.7833	65.7833	66.3838	68.2529	68.5747	69.8929	70.5711	70.5711	69.2275	67.6183	66.9953	67.3054	
alpha	5.3856	5.3856	5.4256	5.5502	5.5716	5.6595	5.7047	5.7047	5.6152	5.5079	5.4664	5.4870	
util living area	0.8485	0.7746	0.6767	0.5395	0.4206	0.3295	0.2637	0.2826	0.3940	0.5950	0.7740	0.8645	(86)
MIT	20.6814	20.8055	20.9087	20.9759	20.9945	20.9989	20.9998	20.9996	20.9970	20.9657	20.8403	20.6595	(87)
Th 2	20.4572	20.4572	20.4619	20.4759	20.4782	20.4876	20.4923	20.4923	20.4829	20.4712	20.4665	20.4689	(88)
util rest of house	0.8348	0.7580	0.6576	0.5194	0.3997	0.3080	0.2418	0.2595	0.3695	0.5701	0.7548	0.8519	(89)
MIT 2	20.0944	20.2401	20.3631	20.4512	20.4731	20.4867	20.4921	20.4921	20.4803	20.4370	20.2924	20.0788	(90)
Living area fraction										fLA = Living area / (4) =		0.2950	(91)
MIT	20.2676	20.4069	20.5241	20.6060	20.6269	20.6378	20.6419	20.6418	20.6328	20.5930	20.4540	20.2501	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2676	20.4069	20.5241	20.6060	20.6269	20.6378	20.6419	20.6418	20.6328	20.5930	20.4540	20.2501	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8298	0.7564	0.6598	0.5244	0.4057	0.3143	0.2483	0.2663	0.3766	0.5759	0.7543	0.8464	(94)
Useful gains	535.0042	559.4518	538.5026	460.7333	362.0269	266.9382	204.2389	207.7672	283.3474	395.1528	474.5731	521.8773	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	624.7340	614.7845	564.4844	467.4283	363.4762	267.2015	204.2933	207.8478	284.0940	404.4898	519.2277	617.4163	(97)
Space heating kWh	66.7590	37.1836	19.3304	4.8204	1.0782	0.0000	0.0000	0.0000	0.0000	6.9467	32.1513	71.0810	(98a)
Space heating requirement - total per year (kWh/year)												239.3507	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	66.7590	37.1836	19.3304	4.8204	1.0782	0.0000	0.0000	0.0000	0.0000	6.9467	32.1513	71.0810	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												239.3507	
Space heating per m2										(98c) / (4) =		3.5735	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 100.0000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	66.7590	37.1836	19.3304	4.8204	1.0782	0.0000	0.0000	0.0000	0.0000	6.9467	32.1513	71.0810	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	66.7590	37.1836	19.3304	4.8204	1.0782	0.0000	0.0000	0.0000	0.0000	6.9467	32.1513	71.0810	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating
Water heating requirement

	252.8315	223.1660	235.6914	203.5457	194.8847	172.9355	168.5810	176.6712	180.1834	204.1471	221.0674	249.5582 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	252.8315	223.1660	235.6914	203.5457	194.8847	172.9355	168.5810	176.6712	180.1834	204.1471	221.0674	249.5582 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	13.8395	12.5002	13.8395	13.3930	13.8395	13.3930	13.8395	13.8395	13.3930	13.8395	13.3930	13.8395 (231)
Lighting	19.6938	15.7991	14.2254	10.4221	8.0503	6.5772	7.3438	9.5457	12.3990	16.2681	18.3748	20.2412 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-14.5004	-24.4566	-41.2721	-54.1163	-63.0963	-59.4946	-59.0499	-52.1048	-42.2605	-29.7811	-17.1561	-12.4702 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.6858	-6.9671	-16.6374	-30.0922	-41.7654	-41.3675	-41.4386	-32.1354	-21.6768	-10.6859	-3.9551	-2.1256 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year

Space heating fuel - main system 1	239.3507 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2483.2633 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	162.9486 (230a)
Total electricity for the above, kWh/year	162.9486 (231)
Electricity for lighting (calculated in Appendix L)	158.9404 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-721.2918 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2323.2113 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	239.3507	25.1600	60.2206	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2483.2633	25.1600	624.7891	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	162.9486	25.1600	40.9979	(249)
Energy for lighting	158.9404	25.1600	39.9894	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-469.7589	25.1600	-118.1913	
PV Unit electricity exported	-251.5329	5.8100	-14.6141	
Total			-132.8054	(252)
Total energy cost			633.1916	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	239.3507	0.1588	38.0061	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2483.2633	0.1413	350.8682	(264)
Space and water heating			388.8743	(265)
Pumps, fans and electric keep-hot	162.9486	0.1387	22.6030	(267)
Energy for lighting	158.9404	0.1443	22.9400	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-469.7589	0.1320	-62.0174	
PV Unit electricity exported	-251.5329	0.1228	-30.8857	
Total			-92.9032	(269)
Total CO2, kg/year			341.5141	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	239.3507	1.5877	380.0235	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2483.2633	1.5225	3780.6954	(278)
Space and water heating			4160.7190	(279)
Pumps, fans and electric keep-hot	162.9486	1.5128	246.5087	(281)
Energy for lighting	158.9404	1.5338	243.7882	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-469.7589	1.4878	-698.8996	
PV Unit electricity exported	-251.5329	0.4506	-113.3491	
Total			-812.2487	(283)
Total Primary energy kWh/year			3838.7671	(286)

SAP 10 EPC IMPROVEMENTS

Unit 387 TH_Copy

Current energy efficiency rating: C 79
Current environmental impact rating: A 96

N Solar water heating	Not applicable
U Solar photovoltaic panels	Not applicable
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 79
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£766	£766	£0
Space heating	£101	£101	£0
Water heating	£625	£625	£0
Lighting	£40	£40	£0
Generated (PV)	-£133	-£133	£0
Total cost of fuels	£633	£633	£0
Total cost of uses	£633	£633	£0
Delivered energy	35 kWh/m²	35 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	57 kWh/m²	57 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	28.0000 (1b)	x	2.6700 (2b)	=	74.7600	(1b) - (3b)
First floor	38.9800 (1c)	x	2.7000 (2c)	=	105.2460	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	180.0060	(5)

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2. Ventilation rate
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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			9.8200	1.2357	12.1350			(27)
Heatloss Floor 1			28.0000	0.1200	3.3600	75.0000	2100.0000	(28a)
External Wall 1	21.7500	9.8200	11.9300	0.1400	1.6702	14.0000	167.0200	(29a)
Total net area of external elements Aum(A, m2)			49.7500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		17.1652			(33)
Party Wall 1			104.6400	0.0000	0.0000	20.0000	2092.8000	(32)
Wall to corridor			11.2000	0.0000	0.0000	20.0000	224.0000	(32)
Party Ceiling 1			38.9800			80.0000	3118.4000	(32b)
Internal Wall 1			120.5500			9.0000	1084.9500	(32c)
Internal Floor 1			38.9800			0.0000	0.0000	(32d)
Internal Ceiling 1			28.0000			9.0000	252.0000	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9039.1700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 134.9533 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	4.2300	0.0500	0.2115
E4 Jamb	13.9100	0.0500	0.6955
E5 Ground floor (normal)	4.1100	0.1600	0.6576
E18 Party wall between dwellings	12.1500	0.0600	0.7290
P1 Party wall - Ground floor	17.7100	0.0800	1.4168
E6 Intermediate floor within a dwelling	3.0300	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	26.2300	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.7104 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 20.8756 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	17.1208	16.9481	16.7755	15.9123	15.7397	14.8765	14.8765	14.7038	15.2218	15.7397	16.0849	16.4302	(38)
Heat transfer coeff	37.9963	37.8237	37.6511	36.7879	36.6152	35.7521	35.7521	35.5794	36.0973	36.6152	36.9605	37.3058	(39)
Average = Sum(39)m / 12 =												36.7447	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5673	0.5647	0.5621	0.5492	0.5467	0.5338	0.5338	0.5312	0.5389	0.5467	0.5518	0.5570	(40)
HLP (average)												0.5486	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1706 (42)
Hot water usage for mixer showers

83.3443	82.0918	80.2666	76.7746	74.1975	71.3236	69.6900	71.5014	73.4869	76.5726	80.1397	83.0250	(42a)

Hot water usage for baths

26.1892	25.8003	25.2526	24.2427	23.4865	22.6480	22.1951	22.7390	23.3311	24.2284	25.2591	26.1007	(42b)

Hot water usage for other uses

36.8595	35.5191	34.1788	32.8384	31.4981	30.1577	30.1577	31.4981	32.8384	34.1788	35.5191	36.8595	(42c)

Average daily hot water use (litres/day) 134.6308 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	146.3930	143.4112	139.6980	133.8557	129.1821	124.1293	122.0428	125.7384	129.6565	134.9798	140.9179	145.9851	(44)
Energy conte	231.8507	204.2156	214.7106	183.2417	173.9039	152.6315	147.6002	155.6904	159.8794	183.1663	200.7634	228.5774	(45)
Energy content (annual)										Total = Sum(45)m =		2236.2313	
Distribution loss (46)m = 0.15 x (45)m	34.7776	30.6323	32.2066	27.4863	26.0856	22.8947	22.1400	23.3536	23.9819	27.4749	30.1145	34.2866	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

252.8315	223.1660	235.6914	203.5457	194.8847	172.9355	168.5810	176.6712	180.1834	204.1471	221.0674	249.5582	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

252.8315	223.1660	235.6914	203.5457	194.8847	172.9355	168.5810	176.6712	180.1834	204.1471	221.0674	249.5582	(64)

Total per year (kWh/year) = Sum(64)m = 2483.2633 (64)
Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month

93.8750	83.0620	88.1759	77.1711	74.6077	66.9932	65.8617	68.5517	69.4031	77.6874	82.9970	92.7866	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	130.2381	130.2381	130.2381	130.2381	130.2381	130.2381	130.2381	130.2381	130.2381	130.2381	130.2381	130.2381	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.4997	19.9840	16.2521	12.3039	9.1973	7.7647	8.3901	10.9057	14.6377	18.5859	21.6925	23.1250	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													

	283.8038	286.7488	279.3275	263.5284	243.5850	224.8409	212.3187	209.3737	216.7950	232.5941	252.5376	271.2816 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	50.1944	50.1944	50.1944	50.1944	50.1944	50.1944	50.1944	50.1944	50.1944	50.1944	50.1944	50.1944 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-86.8254	-86.8254	-86.8254	-86.8254	-86.8254	-86.8254	-86.8254	-86.8254	-86.8254	-86.8254	-86.8254	-86.8254 (71)
Water heating gains (Table 5)												
	126.1761	123.6042	118.5160	107.1821	100.2791	93.0461	88.5238	92.1394	96.3932	104.4186	115.2737	124.7132 (72)
Total internal gains												
	526.0867	523.9441	507.7027	476.6215	446.6685	419.2588	402.8398	406.0260	421.4330	449.2057	483.1108	512.7270 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	9.8200	36.7938	0.6300	0.8270	0.7700	130.4565	(79)

Solar gains	130.4565	222.2157	304.0452	376.7268	421.9654	418.9140	403.8778	370.1278	329.2167	245.5957	156.2569	111.6436 (83)
Total gains	656.5432	746.1598	811.7480	853.3483	868.6339	838.1728	806.7176	776.1538	750.6497	694.8014	639.3676	624.3706 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	66.0822	66.3838	66.6882	68.2529	68.5747	70.2304	70.2304	70.5711	69.5586	68.5747	67.9341	67.3054	
alpha	5.4055	5.4256	5.4459	5.5502	5.5716	5.6820	5.6820	5.7047	5.6372	5.5716	5.5289	5.4870	
util living area													
	0.8291	0.7478	0.6450	0.5148	0.3907	0.2729	0.1950	0.2108	0.3314	0.5392	0.7416	0.8474	(86)
MIT	20.7278	20.8459	20.9324	20.9823	20.9966	20.9997	21.0000	20.9999	20.9990	20.9813	20.8798	20.7042	(87)
Th 2	20.4595	20.4619	20.4642	20.4759	20.4782	20.4900	20.4900	20.4923	20.4853	20.4782	20.4736	20.4689	(88)
util rest of house													
	0.8143	0.7300	0.6249	0.4937	0.3691	0.2512	0.1724	0.1876	0.3068	0.5139	0.7211	0.8336	(89)
MIT 2	20.1520	20.2917	20.3923	20.4582	20.4751	20.4897	20.4899	20.4923	20.4845	20.4602	20.3442	20.1328	(90)
Living area fraction										fLA = Living area / (4) =		0.2950	(91)
MIT	20.3218	20.4552	20.5517	20.6128	20.6290	20.6402	20.6404	20.6421	20.6363	20.6139	20.5022	20.3014	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3218	20.4552	20.5517	20.6128	20.6290	20.6402	20.6404	20.6421	20.6363	20.6139	20.5022	20.3014	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8103	0.7298	0.6282	0.4992	0.3754	0.2576	0.1791	0.1944	0.3140	0.5205	0.7223	0.8290	(94)
Useful gains	532.0170	544.5610	509.9469	426.0253	326.0541	215.8765	144.4463	150.9191	235.7041	361.6691	461.7995	517.6164	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	608.7712	588.3554	529.0598	430.8884	326.9364	215.9486	144.4530	150.9298	235.9416	366.6621	495.3511	600.6743	(97)
Space heating kWh													
	57.1051	29.4298	14.2200	3.5014	0.6565	0.0000	0.0000	0.0000	0.0000	3.7148	24.1572	61.7951	(98a)
Space heating requirement - total per year (kWh/year)												194.5798	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	57.1051	29.4298	14.2200	3.5014	0.6565	0.0000	0.0000	0.0000	0.0000	3.7148	24.1572	61.7951	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												194.5798	
Space heating per m2											(98c) / (4) =	2.9050	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	57.1051	29.4298	14.2200	3.5014	0.6565	0.0000	0.0000	0.0000	0.0000	3.7148	24.1572	61.7951	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	57.1051	29.4298	14.2200	3.5014	0.6565	0.0000	0.0000	0.0000	0.0000	3.7148	24.1572	61.7951	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	252.8315	223.1660	235.6914	203.5457	194.8847	172.9355	168.5810	176.6712	180.1834	204.1471	221.0674	249.5582	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	252.8315	223.1660	235.6914	203.5457	194.8847	172.9355	168.5810	176.6712	180.1834	204.1471	221.0674	249.5582	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.8395	12.5002	13.8395	13.3930	13.8395	13.3930	13.8395	13.8395	13.3930	13.8395	13.3930	13.8395	(231)
Lighting	19.6938	15.7991	14.2254	10.4221	8.0503	6.5772	7.3438	9.5457	12.3990	16.2681	18.3748	20.2412	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.9966	-25.3825	-41.2114	-51.8878	-60.9356	-58.6429	-57.7145	-52.0890	-42.5409	-31.0515	-18.4313	-13.4855	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													

(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.1789	-7.4900	-16.7180	-27.9532	-39.1596	-40.2508	-39.6760	-32.1173	-21.9353	-11.5369	-4.4949	-2.4337	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	194.5798	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2483.2633	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	162.9486	(230a)
Total electricity for the above, kWh/year	162.9486	(231)
Electricity for lighting (calculated in Appendix L)	158.9404	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-716.3140	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2283.4182	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	194.5798	16.4900	32.0862	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2483.2633	16.4900	409.4901	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	162.9486	16.4900	26.8702	(249)
Energy for lighting	158.9404	16.4900	26.2093	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-469.3694	16.4900	-77.3990	
PV Unit electricity exported	-246.9445	5.5900	-13.8042	
Total			-91.2032	(252)
Total energy cost			403.4526	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2970	(257)
SAP value		78.9749	
SAP rating (Section 12)		79	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	194.5798	0.1593	31.0054	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2483.2633	0.1413	350.8682	(264)
Space and water heating			381.8736	(265)
Pumps, fans and electric keep-hot	162.9486	0.1387	22.6030	(267)
Energy for lighting	158.9404	0.1443	22.9400	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-469.3694	0.1323	-62.1091	
PV Unit electricity exported	-246.9445	0.1233	-30.4480	
Total			-92.5571	(269)
Total CO2, kg/year			334.8596	(272)
CO2 emissions per m2			5.0000	(273)
EI value			95.9929	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area	Storey height	Volume

	(m2)		(m)		(m3)	
Ground floor	28.0000 (1b)	x	2.6700 (2b)	=	74.7600	(1b) - (3b)
First floor	38.9800 (1c)	x	2.7000 (2c)	=	105.2460	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	180.0060	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			9.8200	1.2357	12.1350			(27)
Heatloss Floor 1			28.0000	0.1200	3.3600	75.0000	2100.0000	(28a)
External Wall 1	21.7500	9.8200	11.9300	0.1400	1.6702	14.0000	167.0200	(29a)
Total net area of external elements Aum(A, m2)			49.7500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		17.1652			(33)
Party Wall 1			104.6400	0.0000	0.0000	20.0000	2092.8000	(32)
Wall to corridor			11.2000	0.0000	0.0000	20.0000	224.0000	(32)
Party Ceiling 1			38.9800			80.0000	3118.4000	(32b)
Internal Wall 1			120.5500			9.0000	1084.9500	(32c)
Internal Floor 1			38.9800			0.0000	0.0000	(32d)
Internal Ceiling 1			28.0000			9.0000	252.0000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9039.1700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		134.9533 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	4.2300	0.0500	0.2115
E4 Jamb	13.9100	0.0500	0.6955
E5 Ground floor (normal)	4.1100	0.1600	0.6576
E18 Party wall between dwellings	12.1500	0.0600	0.7290
P1 Party wall - Ground floor	17.7100	0.0800	1.4168
E6 Intermediate floor within a dwelling	3.0300	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	26.2300	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.7104 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	20.8756 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	17.2934	17.2934	16.9481	15.9123	15.7397	15.0491	14.7038	14.7038	15.3944	16.2576	16.6029	16.4302	(38)
Heat transfer coeff	38.1690	38.1690	37.8237	36.7879	36.6152	35.9247	35.5794	35.5794	36.2700	37.1332	37.4784	37.3058	(39)
Average = Sum(39)m / 12 =												36.9030	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5699	0.5699	0.5647	0.5492	0.5467	0.5363	0.5312	0.5312	0.5415	0.5544	0.5595	0.5570	(40)
HLP (average)												0.5510	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1706 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	83.3443	82.0918	80.2666	76.7746	74.1975	71.3236	69.6900	71.5014	73.4869	76.5726	80.1397	83.0250	(42a)
Hot water usage for baths	26.1892	25.8003	25.2526	24.2427	23.4865	22.6480	22.1951	22.7390	23.3311	24.2284	25.2591	26.1007	(42b)
Hot water usage for other uses	36.8595	35.5191	34.1788	32.8384	31.4981	30.1577	30.1577	31.4981	32.8384	34.1788	35.5191	36.8595	(42c)
Average daily hot water use (litres/day)												134.6308	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

	146.3930	143.4112	139.6980	133.8557	129.1821	124.1293	122.0428	125.7384	129.6565	134.9798	140.9179	145.9851	(44)
Energy conte	231.8507	204.2156	214.7106	183.2417	173.9039	152.6315	147.6002	155.6904	159.8794	183.1663	200.7634	228.5774	(45)
Energy content (annual)											Total = Sum(45)m =	2236.2313	
Distribution loss (46)m = 0.15 x (45)m													
	34.7776	30.6323	32.2066	27.4863	26.0856	22.8947	22.1400	23.3536	23.9819	27.4749	30.1145	34.2866	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	252.8315	223.1660	235.6914	203.5457	194.8847	172.9355	168.5810	176.6712	180.1834	204.1471	221.0674	249.5582	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	252.8315	223.1660	235.6914	203.5457	194.8847	172.9355	168.5810	176.6712	180.1834	204.1471	221.0674	249.5582	(64)
											Total per year (kWh/year) = Sum(64)m =	2483.2633	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Heat gains from water heating, kWh/month													
	93.8750	83.0620	88.1759	77.1711	74.6077	66.9932	65.8617	68.5517	69.4031	77.6874	82.9970	92.7866	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	130.2381	130.2381	130.2381	130.2381	130.2381	130.2381	130.2381	130.2381	130.2381	130.2381	130.2381	130.2381	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.4997	19.9840	16.2521	12.3039	9.1973	7.7647	8.3901	10.9057	14.6377	18.5859	21.6925	23.1250	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	283.8038	286.7488	279.3275	263.5284	243.5850	224.8409	212.3187	209.3737	216.7950	232.5941	252.5376	271.2816	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.1944	50.1944	50.1944	50.1944	50.1944	50.1944	50.1944	50.1944	50.1944	50.1944	50.1944	50.1944	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-86.8254	-86.8254	-86.8254	-86.8254	-86.8254	-86.8254	-86.8254	-86.8254	-86.8254	-86.8254	-86.8254	-86.8254	(71)
Water heating gains (Table 5)													
	126.1761	123.6042	118.5160	107.1821	100.2791	93.0461	88.5238	92.1394	96.3932	104.4186	115.2737	124.7132	(72)
Total internal gains													
	526.0867	523.9441	507.7027	476.6215	446.6685	419.2588	402.8398	406.0260	421.4330	449.2057	483.1108	512.7270	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	9.8200	33.4622	0.6300	0.8270	0.7700	118.6440	(79)

Solar gains	118.6440	215.6965	308.4326	401.9936	445.7075	430.0534	419.7654	374.0824	330.9765	236.9621	146.0439	103.8353	(83)
Total gains	644.7306	739.6407	816.1353	878.6151	892.3760	849.3123	822.6052	780.1084	752.4096	686.1678	629.1547	616.5622	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	65.7833	65.7833	66.3838	68.2529	68.5747	69.8929	70.5711	70.5711	69.2275	67.6183	66.9953	67.3054	
alpha	5.3856	5.3856	5.4256	5.5502	5.5716	5.6595	5.7047	5.7047	5.6152	5.5079	5.4664	5.4870	
util living area													
	0.8485	0.7746	0.6767	0.5395	0.4206	0.3295	0.2637	0.2826	0.3940	0.5950	0.7740	0.8645	(86)
MIT	20.6814	20.8055	20.9087	20.9759	20.9945	20.9989	20.9998	20.9996	20.9970	20.9657	20.8403	20.6595	(87)
Th 2	20.4572	20.4572	20.4619	20.4759	20.4782	20.4876	20.4923	20.4923	20.4829	20.4712	20.4665	20.4689	(88)
util rest of house													
	0.8348	0.7580	0.6576	0.5194	0.3997	0.3080	0.2418	0.2595	0.3695	0.5701	0.7548	0.8519	(89)
MIT 2	20.0944	20.2401	20.3631	20.4512	20.4731	20.4867	20.4921	20.4921	20.4803	20.4370	20.2924	20.0788	(90)
Living area fraction									fLA = Living area / (4) =			0.2950	(91)
MIT	20.2676	20.4069	20.5241	20.6060	20.6269	20.6378	20.6419	20.6418	20.6328	20.5930	20.4540	20.2501	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2676	20.4069	20.5241	20.6060	20.6269	20.6378	20.6419	20.6418	20.6328	20.5930	20.4540	20.2501	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8298	0.7564	0.6598	0.5244	0.4057	0.3143	0.2483	0.2663	0.3766	0.5759	0.7543	0.8464	(94)
Useful gains	535.0042	559.4518	538.5026	460.7333	362.0269	266.9382	204.2389	207.7672	283.3474	395.1528	474.5731	521.8773	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	624.7340	614.7845	564.4844	467.4283	363.4762	267.2015	204.2933	207.8478	284.0940	404.4898	519.2277	617.4163	(97)
Space heating kWh													
	66.7590	37.1836	19.3304	4.8204	1.0782	0.0000	0.0000	0.0000	0.0000	6.9467	32.1513	71.0810	(98a)
Space heating requirement - total per year (kWh/year)												239.3507	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	66.7590	37.1836	19.3304	4.8204	1.0782	0.0000	0.0000	0.0000	0.0000	6.9467	32.1513	71.0810	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 239.3507
Space heating per m2 (98c) / (4) = 3.5735 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 100.0000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	66.7590	37.1836	19.3304	4.8204	1.0782	0.0000	0.0000	0.0000	0.0000	6.9467	32.1513	71.0810	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000		(210)
Space heating fuel (main heating system)													
	66.7590	37.1836	19.3304	4.8204	1.0782	0.0000	0.0000	0.0000	0.0000	6.9467	32.1513	71.0810	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	252.8315	223.1660	235.6914	203.5457	194.8847	172.9355	168.5810	176.6712	180.1834	204.1471	221.0674	249.5582	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	252.8315	223.1660	235.6914	203.5457	194.8847	172.9355	168.5810	176.6712	180.1834	204.1471	221.0674	249.5582	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.8395	12.5002	13.8395	13.3930	13.8395	13.3930	13.8395	13.8395	13.3930	13.8395	13.3930	13.8395	(231)
Lighting	19.6938	15.7991	14.2254	10.4221	8.0503	6.5772	7.3438	9.5457	12.3990	16.2681	18.3748	20.2412	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.5004	-24.4566	-41.2721	-54.1163	-63.0963	-59.4946	-59.0499	-52.1048	-42.2605	-29.7811	-17.1561	-12.4702	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.6858	-6.9671	-16.6374	-30.0922	-41.7654	-41.3675	-41.4386	-32.1354	-21.6768	-10.6859	-3.9551	-2.1256	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year
Space heating fuel - main system 1 239.3507 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 100.0000
Water heating fuel used 2483.2633 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)
mechanical ventilation fans (SFP = 0.7420) 162.9486 (230a)
Total electricity for the above, kWh/year 162.9486 (231)
Electricity for lighting (calculated in Appendix L) 158.9404 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation -721.2918 (233)
Wind generation 0.0000 (234)
Hydro-electric generation (Appendix N) 0.0000 (235a)
Electricity generated - Micro CHP (Appendix N) 0.0000 (235)
Appendix Q - special features
Energy saved or generated -0.0000 (236)
Energy used 0.0000 (237)
Total delivered energy for all uses 2323.2113 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	239.3507	25.1600	60.2206	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2483.2633	25.1600	624.7891	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	162.9486	25.1600	40.9979	(249)
Energy for lighting	158.9404	25.1600	39.9894	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-469.7589	25.1600	-118.1913	
PV Unit electricity exported	-251.5329	5.8100	-14.6141	
Total			-132.8054	(252)
Total energy cost			633.1916	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	239.3507	0.1588	38.0061	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2483.2633	0.1413	350.8682	(264)
Space and water heating			388.8743	(265)

Pumps, fans and electric keep-hot	162.9486	0.1387	22.6030	(267)
Energy for lighting	158.9404	0.1443	22.9400	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-469.7589	0.1320	-62.0174	
PV Unit electricity exported	-251.5329	0.1228	-30.8857	
Total			-92.9032	(269)
Total CO2, kg/year			341.5141	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	239.3507	1.5877	380.0235	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2483.2633	1.5225	3780.6954	(278)
Space and water heating			4160.7190	(279)
Pumps, fans and electric keep-hot	162.9486	1.5128	246.5087	(281)
Energy for lighting	158.9404	1.5338	243.7882	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-469.7589	1.4878	-698.8996	
PV Unit electricity exported	-251.5329	0.4506	-113.3491	
Total			-812.2487	(283)
Total Primary energy kWh/year			3838.7671	(286)

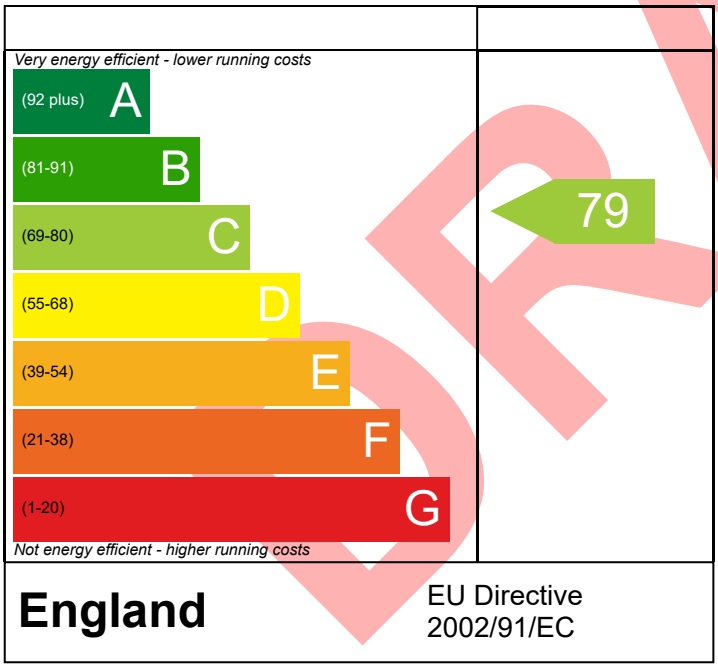
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	66.98 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

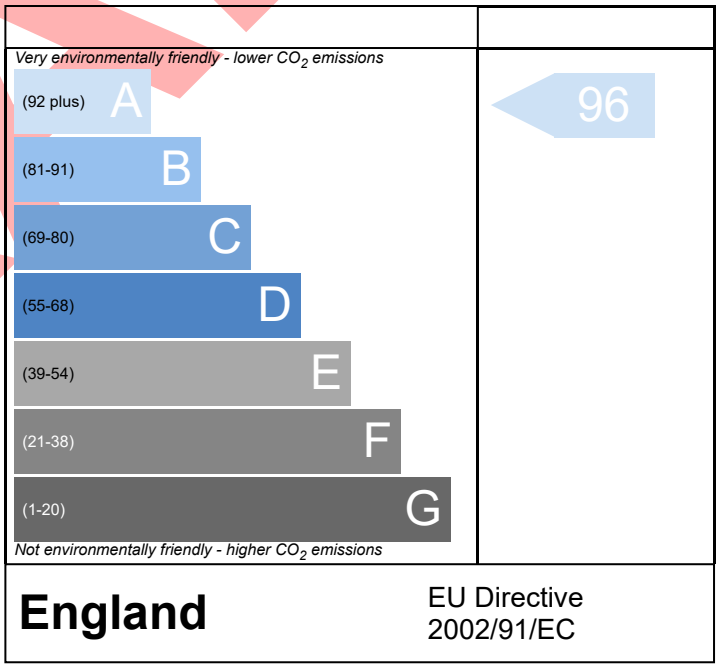
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:16

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	85 m^2
Site Reference	Unit 388 TH GF_Copy	Plot Reference	Unit 388 TH_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.93 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	5.58 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*64.19 kWh$_{PE}$/m^2*	
Dwelling primary energy	61.6 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*30.5 kWh/m^2*	
Dwelling fabric energy efficiency	29.0 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.12	Heatloss Floor 1 (0.12)	OK
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	60.74	0.14 **(!)**
Party wall: Party Wall (1)	70.35	0 **(!)**
Party wall: Party Wall (2)	20.43	0 **(!)**
Ground floor: Heatloss Floor 1, Heatloss Floor 1	38.51	0.12

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	13.76	South West	0.83	1.3
SE, Opening Type 1	11.81	South East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.16	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.08	
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0 **(!)**	
Party wall	P2: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0 **(!)**	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	1.1 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 388 TH GF_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 388 TH_Copy	**Prop Type Ref**	Unit 388 TH GF
Property			

SAP Rating	75 C	**DER**	5.58	**TER**	11.93
Environmental	95 A	**% DER < TER**			53.23
CO_2 Emissions (t/year)	0.48	**DFEE**	29.03	**TFEE**	30.52
Compliance Check	See BREL	**% DFEE < TFEE**			4.89
% DPER < TPER	4.03	**DPER**	61.60	**TPER**	64.19

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	38.5100 (1b)	x	2.6700 (2b)	=	102.8217	(1b) - (3b)
First floor	46.2700 (1c)	x	2.7000 (2c)	=	124.9290	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	227.7507	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			25.5700	1.2357	31.5979			(27)
Heatloss Floor 1			38.5100	0.1200	4.6212	75.0000	2888.2500	(28a)
External Wall 1	86.3100	25.5700	60.7400	0.1400	8.5036	14.0000	850.3600	(29a)
Total net area of external elements Aum(A, m2)			124.8200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.7227			(33)
Party Wall 1			70.3500	0.0000	0.0000	20.0000	1407.0000	(32)
Wall to corridor			20.4300	0.0000	0.0000	20.0000	408.6000	(32)
Party Ceiling 1			38.9800			80.0000	3118.4000	(32b)
Internal Wall 1			188.6800			9.0000	1698.1200	(32c)
Internal Floor 1			46.2700			0.0000	0.0000	(32d)
Internal Ceiling 1			46.2700			9.0000	416.4300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 10787.1600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	127.2371 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0200	0.0500	0.5510
E4 Jamb	30.1500	0.0500	1.5075
E5 Ground floor (normal)	12.9600	0.1600	2.0736
E18 Party wall between dwellings	6.0700	0.0600	0.3642
P1 Party wall - Ground floor	14.4100	0.0800	1.1528
E6 Intermediate floor within a dwelling	15.4800	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	15.4800	0.0000	0.0000
E16 Corner (normal)	6.0700	0.0900	0.5463

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.1954 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 50.9181 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.7399	22.5003	22.2608	21.0630	20.8234	19.6256	19.6256	19.3860	20.1047	20.8234	21.3025	21.7816	(38)
Heat transfer coeff	73.6580	73.4185	73.1789	71.9811	71.7415	70.5437	70.5437	70.3041	71.0228	71.7415	72.2206	72.6998	(39)
Average = Sum(39)m / 12 =												71.9212	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8688	0.8660	0.8632	0.8490	0.8462	0.8321	0.8321	0.8293	0.8377	0.8462	0.8519	0.8575	(40)
HLP (average)												0.8483	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5473 (42)
Hot water usage for mixer showers

92.0289	90.6458	88.6305	84.7746	81.9290	78.7556	76.9518	78.9519	81.1443	84.5516	88.4904	91.6763	(42a)

Hot water usage for baths

28.9053	28.4761	27.8715	26.7569	25.9223	24.9968	24.4969	25.0972	25.7508	26.7411	27.8787	28.8076	(42b)

Hot water usage for other uses

40.7172	39.2366	37.7560	36.2753	34.7947	33.3141	33.3141	34.7947	36.2753	37.7560	39.2366	40.7172	(42c)

Average daily hot water use (litres/day) 148.6630 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	161.6514	158.3585	154.2580	147.8068	142.6459	137.0665	134.7628	138.8438	143.1705	149.0487	155.6057	161.2011	(44)
Energy conte	256.0163	225.5004	237.0888	202.3401	192.0289	168.5392	162.9840	171.9177	176.5436	202.2576	221.6888	252.4020	(45)
Energy content (annual)										Total = Sum(45)m =		2469.3073	

Distribution loss (46)m = 0.15 x (45)m

38.4024	33.8251	35.5633	30.3510	28.8043	25.2809	24.4476	25.7876	26.4815	30.3386	33.2533	37.8603	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

276.9971	244.4508	258.0696	222.6441	213.0097	188.8432	183.9648	192.8985	196.8476	223.2384	241.9928	273.3828	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

276.9971	244.4508	258.0696	222.6441	213.0097	188.8432	183.9648	192.8985	196.8476	223.2384	241.9928	273.3828	(64)

Total per year (kWh/year) = Sum(64)m = 2716.3393 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

101.9101	90.1392	95.6167	83.5213	80.6342	72.2825	70.9768	73.9473	74.9439	84.0353	89.9547	100.7083	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	152.8398	152.8398	152.8398	152.8398	152.8398	152.8398	152.8398	152.8398	152.8398	152.8398	152.8398	152.8398	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.3763	23.4272	19.0523	14.4238	10.7820	9.1026	9.8357	12.7848	17.1597	21.7882	25.4300	27.1094	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	342.0005	345.5494	336.6063	317.5675	293.5344	270.9467	255.8568	252.3079	261.2510	280.2898	304.3228	326.9105	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8313	52.8313	52.8313	52.8313	52.8313	52.8313	52.8313	52.8313	52.8313	52.8313	52.8313	52.8313	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-101.8932	-101.8932	-101.8932	-101.8932	-101.8932	-101.8932	-101.8932	-101.8932	-101.8932	-101.8932	-101.8932	-101.8932	(71)
Water heating gains (Table 5)	136.9759	134.1357	128.5170	116.0018	108.3794	100.3923	95.3989	99.3915	104.0888	112.9507	124.9371	135.3606	(72)
Total internal gains	609.1307	606.8903	587.9535	551.7710	516.4737	484.2196	464.8693	468.2620	486.2774	518.8066	558.4679	593.1585	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	11.8100	36.7938	0.6300	0.8270	0.7700	156.8932	(77)
Southwest	13.7600	36.7938	0.6300	0.8270	0.7700	182.7986	(79)

Solar gains	339.6918	578.6208	791.6942	980.9475	1098.7429	1090.7974	1051.6451	963.7644	857.2374	639.4992	406.8725	290.7054	(83)
Total gains	948.8224	1185.5110	1379.6477	1532.7185	1615.2166	1575.0170	1516.5144	1432.0265	1343.5148	1158.3058	965.3404	883.8639	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.6803	40.8131	40.9467	41.6281	41.7671	42.4763	42.4763	42.6210	42.1897	41.7671	41.4900	41.2166	
alpha	3.7120	3.7209	3.7298	3.7752	3.7845	3.8318	3.8318	3.8414	3.8126	3.7845	3.7660	3.7478	
util living area	0.8764	0.7870	0.6753	0.5371	0.4044	0.2849	0.2043	0.2253	0.3598	0.5947	0.8054	0.8952	(86)
MIT	20.1011	20.4378	20.7076	20.8916	20.9682	20.9939	20.9987	20.9981	20.9847	20.8700	20.4865	20.0263	(87)
Th 2	20.1941	20.1965	20.1989	20.2110	20.2135	20.2256	20.2256	20.2281	20.2208	20.2135	20.2086	20.2038	(88)
util rest of house	0.8618	0.7663	0.6491	0.5072	0.3721	0.2510	0.1685	0.1877	0.3206	0.5585	0.7824	0.8823	(89)
MIT 2	19.1723	19.5750	19.8890	20.1038	20.1853	20.2212	20.2249	20.2270	20.2091	20.0887	19.6515	19.0893	(90)
Living area fraction										fLA = Living area / (4) =		0.3094	(91)
MIT	19.4596	19.8419	20.1423	20.3475	20.4275	20.4602	20.4643	20.4656	20.4490	20.3304	19.9099	19.3792	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4596	19.8419	20.1423	20.3475	20.4275	20.4602	20.4643	20.4656	20.4490	20.3304	19.9099	19.3792	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8467	0.7566	0.6472	0.5124	0.3810	0.2613	0.1796	0.1993	0.3321	0.5640	0.7731	0.8670	(94)
Useful gains	803.4139	896.9407	892.9491	785.4192	615.3897	411.5881	272.2926	285.3580	446.2375	653.2924	746.2598	766.3099	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1116.6286	1097.0146	998.3262	824.0043	626.1241	413.4033	272.6043	285.8270	450.9265	698.0731	925.1359	1103.5248	(97)
Space heating kWh	233.0318	134.4497	78.4006	27.7813	7.9864	0.0000	0.0000	0.0000	0.0000	33.3168	128.7908	250.8879	(98a)
Space heating requirement - total per year (kWh/year)												894.6451	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	233.0318	134.4497	78.4006	27.7813	7.9864	0.0000	0.0000	0.0000	33.3168	128.7908	250.8879	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												894.6451	
Space heating per m2											(98c) / (4) =	10.5525	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 100.0000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	233.0318	134.4497	78.4006	27.7813	7.9864	0.0000	0.0000	0.0000	0.0000	33.3168	128.7908	250.8879	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	233.0318	134.4497	78.4006	27.7813	7.9864	0.0000	0.0000	0.0000	0.0000	33.3168	128.7908	250.8879	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.9971	244.4508	258.0696	222.6441	213.0097	188.8432	183.9648	192.8985	196.8476	223.2384	241.9928	273.3828	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	276.9971	244.4508	258.0696	222.6441	213.0097	188.8432	183.9648	192.8985	196.8476	223.2384	241.9928	273.3828	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	17.5102	15.8157	17.5102	16.9454	17.5102	16.9454	17.5102	17.5102	16.9454	17.5102	16.9454	17.5102	(231)
Lighting	23.0871	18.5213	16.6764	12.2178	9.4374	7.7104	8.6091	11.1905	14.5353	19.0711	21.5407	23.7287	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-20.4624	-32.3772	-52.1532	-64.8758	-75.4292	-72.1993	-71.0498	-64.2488	-52.6470	-39.0007	-23.4883	-17.2570	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.7824	-9.1858	-21.0908	-36.0726	-51.1279	-52.8387	-52.0877	-42.2189	-28.8746	-14.8467	-5.4989	-2.8707	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												894.6451	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2716.3393	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)
mechanical ventilation fans (SFP = 0.7420) 206.1690 (230a)

Total electricity for the above, kWh/year 206.1690 (231)

Electricity for lighting (calculated in Appendix L) 186.3258 (232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-905.6843	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3097.7950	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	894.6451	16.4900	147.5270	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2716.3393	16.4900	447.9243	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	206.1690	16.4900	33.9973	(249)
Energy for lighting	186.3258	16.4900	30.7251	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-585.1886	16.4900	-96.4976	
PV Unit electricity exported	-320.4957	5.5900	-17.9157	
Total			-114.4133	(252)
Total energy cost			545.7604	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.5139	(257)
SAP value		75.4597	
SAP rating (Section 12)		75	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	894.6451	0.1580	141.3916	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2716.3393	0.1413	383.8667	(264)
Space and water heating			525.2583	(265)
Pumps, fans and electric keep-hot	206.1690	0.1387	28.5982	(267)
Energy for lighting	186.3258	0.1443	26.8926	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-585.1886	0.1325	-77.5620	
PV Unit electricity exported	-320.4957	0.1227	-39.3314	
Total			-116.8934	(269)
Total CO2, kg/year			463.8557	(272)
CO2 emissions per m2			5.4700	(273)
EI value			95.2106	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	38.5100 (1b)	x	2.6700 (2b)	=	102.8217	(1b) - (3b)
First floor	46.2700 (1c)	x	2.7000 (2c)	=	124.9290	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 84.7800						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		227.7507	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)

Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	3.0000	(17)
Infiltration rate	0.1500	(18)
Number of sides sheltered	2	(19)
Shelter factor (20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			25.5700	1.2357	31.5979			(27)
Heatloss Floor 1			38.5100	0.1200	4.6212	75.0000	2888.2500	(28a)
External Wall 1	86.3100	25.5700	60.7400	0.1400	8.5036	14.0000	850.3600	(29a)
Total net area of external elements Aum(A, m2)			124.8200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.7227			(33)
Party Wall 1			70.3500	0.0000	0.0000	20.0000	1407.0000	(32)
Wall to corridor			20.4300	0.0000	0.0000	20.0000	408.6000	(32)
Party Ceiling 1			38.9800			80.0000	3118.4000	(32b)
Internal Wall 1			188.6800			9.0000	1698.1200	(32c)
Internal Floor 1			46.2700			0.0000	0.0000	(32d)
Internal Ceiling 1			46.2700			9.0000	416.4300	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) =	10787.1600	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	127.2371	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0200	0.0500	0.5510
E4 Jamb	30.1500	0.0500	1.5075
E5 Ground floor (normal)	12.9600	0.1600	2.0736
E18 Party wall between dwellings	6.0700	0.0600	0.3642
P1 Party wall - Ground floor	14.4100	0.0800	1.1528
E6 Intermediate floor within a dwelling	15.4800	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	15.4800	0.0000	0.0000
E16 Corner (normal)	6.0700	0.0900	0.5463

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.1954	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	50.9181	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.9795	22.9795	22.5003	21.0630	20.8234	19.8651	19.3860	19.3860	20.3443	21.5421	22.0212	21.7816	(38)
Heat transfer coeff	73.8976	73.8976	73.4185	71.9811	71.7415	70.7832	70.3041	70.3041	71.2624	72.4602	72.9393	72.6998	(39)
Average = Sum(39)m / 12 =												72.1408	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8716	0.8716	0.8660	0.8490	0.8462	0.8349	0.8293	0.8293	0.8406	0.8547	0.8603	0.8575	(40)
HLP (average)												0.8509	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5473	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	92.0289	90.6458	88.6305	84.7746	81.9290	78.7556	76.9518	78.9519	81.1443	84.5516	88.4904	91.6763	(42a)
Hot water usage for baths	28.9053	28.4761	27.8715	26.7569	25.9223	24.9968	24.4969	25.0972	25.7508	26.7411	27.8787	28.8076	(42b)
Hot water usage for other uses	40.7172	39.2366	37.7560	36.2753	34.7947	33.3141	33.3141	34.7947	36.2753	37.7560	39.2366	40.7172	(42c)
Average daily hot water use (litres/day)												148.6630	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	161.6514	158.3585	154.2580	147.8068	142.6459	137.0665	134.7628	138.8438	143.1705	149.0487	155.6057	161.2011	(44)
Energy conte	256.0163	225.5004	237.0888	202.3401	192.0289	168.5392	162.9840	171.9177	176.5436	202.2576	221.6888	252.4020	(45)
Energy content (annual)										Total = Sum(45)m =		2469.3073	
Distribution loss (46)m = 0.15 x (45)m	38.4024	33.8251	35.5633	30.3510	28.8043	25.2809	24.4476	25.7876	26.4815	30.3386	33.2533	37.8603	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	276.9971	244.4508	258.0696	222.6441	213.0097	188.8432	183.9648	192.8985	196.8476	223.2384	241.9928	273.3828	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.9971	244.4508	258.0696	222.6441	213.0097	188.8432	183.9648	192.8985	196.8476	223.2384	241.9928	273.3828	(64)
Total per year (kWh/year) = Sum(64)m =												2716.3393	(64)

Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

	101.9101	90.1392	95.6167	83.5213	80.6342	72.2825	70.9768	73.9473	74.9439	84.0353	89.9547	100.7083 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	152.8398	152.8398	152.8398	152.8398	152.8398	152.8398	152.8398	152.8398	152.8398	152.8398	152.8398	152.8398	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	26.3763	23.4272	19.0523	14.4238	10.7820	9.1026	9.8357	12.7848	17.1597	21.7882	25.4300	27.1094	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	342.0005	345.5494	336.6063	317.5675	293.5344	270.9467	255.8568	252.3079	261.2510	280.2898	304.3228	326.9105	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	52.8313	52.8313	52.8313	52.8313	52.8313	52.8313	52.8313	52.8313	52.8313	52.8313	52.8313	52.8313	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-101.8932	-101.8932	-101.8932	-101.8932	-101.8932	-101.8932	-101.8932	-101.8932	-101.8932	-101.8932	-101.8932	-101.8932	(71)

Water heating gains (Table 5)

	136.9759	134.1357	128.5170	116.0018	108.3794	100.3923	95.3989	99.3915	104.0888	112.9507	124.9371	135.3606	(72)

Total internal gains

	609.1307	606.8903	587.9535	551.7710	516.4737	484.2196	464.8693	468.2620	486.2774	518.8066	558.4679	593.1585	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	11.8100	33.4622	0.6300	0.8270	0.7700	142.6869	(77)
Southwest	13.7600	33.4622	0.6300	0.8270	0.7700	166.2465	(79)

Solar gains	308.9334	561.6457	803.1183	1046.7390	1160.5642	1119.8030	1093.0145	974.0618	861.8197	617.0184	380.2794	270.3735	(83)
Total gains	918.0641	1168.5359	1391.0718	1598.5100	1677.0379	1604.0226	1557.8838	1442.3239	1348.0971	1135.8250	938.7473	863.5320	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.5485	40.5485	40.8131	41.6281	41.7671	42.3325	42.6210	42.6210	42.0479	41.3528	41.0812	41.2166	
alpha	3.7032	3.7032	3.7209	3.7752	3.7845	3.8222	3.8414	3.8414	3.8032	3.7569	3.7387	3.7478	
util living area	0.8923	0.8083	0.7001	0.5540	0.4293	0.3404	0.2739	0.3001	0.4231	0.6463	0.8309	0.9080	(86)
MIT	19.9983	20.3475	20.6460	20.8698	20.9569	20.9859	20.9950	20.9930	20.9681	20.8081	20.3885	19.9278	(87)
Th 2	20.1917	20.1917	20.1965	20.2110	20.2135	20.2232	20.2281	20.2281	20.2183	20.2062	20.2013	20.2038	(88)
util rest of house	0.8792	0.7893	0.6757	0.5260	0.3988	0.3075	0.2397	0.2634	0.3853	0.6125	0.8102	0.8966	(89)
MIT 2	19.0445	19.4630	19.8152	20.0791	20.1736	20.2117	20.2246	20.2231	20.1913	20.0154	19.5295	18.9675	(90)
Living area fraction									fLA = Living area / (4) =			0.3094	(91)
MIT	19.3396	19.7367	20.0722	20.3237	20.4160	20.4513	20.4629	20.4613	20.4316	20.2607	19.7952	19.2646	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3396	19.7367	20.0722	20.3237	20.4160	20.4513	20.4629	20.4613	20.4316	20.2607	19.7952	19.2646	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8636	0.7778	0.6718	0.5301	0.4067	0.3172	0.2501	0.2745	0.3957	0.6149	0.7987	0.8810	(94)
Useful gains	792.8070	908.8859	934.5736	847.3714	682.1262	508.7677	389.6455	395.9565	533.4415	698.3908	749.7753	760.7952	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	1140.9510	1140.7332	1062.5271	894.2744	697.0380	513.2674	391.0959	398.0102	543.8491	765.2270	962.4526	1131.5423	(97)
Space heating kWh	259.0191	155.8014	95.1974	33.7701	11.0944	0.0000	0.0000	0.0000	0.0000	49.7261	153.1276	275.8358	(98a)

Space heating requirement - total per year (kWh/year) 1033.5719

Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)

Solar heating contribution - total per year (kWh/year) 0.0000

Space heating kWh	259.0191	155.8014	95.1974	33.7701	11.0944	0.0000	0.0000	0.0000	0.0000	49.7261	153.1276	275.8358	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 1033.5719

Space heating per m2 (98c) / (4) = 12.1912 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 100.0000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	259.0191	155.8014	95.1974	33.7701	11.0944	0.0000	0.0000	0.0000	0.0000	49.7261	153.1276	275.8358	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	259.0191	155.8014	95.1974	33.7701	11.0944	0.0000	0.0000	0.0000	0.0000	49.7261	153.1276	275.8358	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)

Space heating fuel (main heating system 2)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	276.9971	244.4508	258.0696	222.6441	213.0097	188.8432	183.9648	192.8985	196.8476	223.2384	241.9928	273.3828	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	276.9971	244.4508	258.0696	222.6441	213.0097	188.8432	183.9648	192.8985	196.8476	223.2384	241.9928	273.3828	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	17.5102	15.8157	17.5102	16.9454	17.5102	16.9454	17.5102	17.5102	16.9454	17.5102	16.9454	17.5102	(231)
Lighting	23.0871	18.5213	16.6764	12.2178	9.4374	7.7104	8.6091	11.1905	14.5353	19.0711	21.5407	23.7287	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-18.5566	-31.2493	-52.3722	-67.7726	-78.1786	-73.2282	-72.6624	-64.2680	-52.3048	-37.5529	-21.8999	-15.9638	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.1731	-8.4819	-20.8467	-38.6979	-54.4052	-54.2986	-54.3920	-42.2426	-28.5356	-13.6122	-4.7924	-2.4907	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1033.5719	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2716.3393	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	206.1690	(230a)
Total electricity for the above, kWh/year	206.1690	(231)
Electricity for lighting (calculated in Appendix L)	186.3258	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-911.9781	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3230.4279	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1033.5719	25.1600	260.0467	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2716.3393	25.1600	683.4310	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	206.1690	25.1600	51.8721	(249)
Energy for lighting	186.3258	25.1600	46.8796	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-586.0094	25.1600	-147.4400	
PV Unit electricity exported	-325.9687	5.8100	-18.9388	
Total			-166.3788	(252)
Total energy cost			875.8506	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1033.5719	0.1576	162.8534	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2716.3393	0.1413	383.8667	(264)
Space and water heating			546.7201	(265)
Pumps, fans and electric keep-hot	206.1690	0.1387	28.5982	(267)
Energy for lighting	186.3258	0.1443	26.8926	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-586.0094	0.1322	-77.4969	
PV Unit electricity exported	-325.9687	0.1222	-39.8269	
Total			-117.3239	(269)
Total CO2, kg/year			484.8870	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1033.5719	1.5832	1636.3769	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2716.3393	1.5226	4135.7959	(278)
Space and water heating			5772.1728	(279)
Pumps, fans and electric keep-hot	206.1690	1.5128	311.8925	(281)
Energy for lighting	186.3258	1.5338	285.7927	(282)
Energy saving/generation technologies				

PV Unit electricity used in dwelling	-586.0094	1.4886	-872.3530
PV Unit electricity exported	-325.9687	0.4484	-146.1530
Total			-1018.5060 (283)
Total Primary energy kWh/year			5351.3520 (286)

SAP 10 EPC IMPROVEMENTS

Unit 388 TH_Copy

Current energy efficiency rating: C 75
Current environmental impact rating: A 95

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 75
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£1042	£1042	£0
Space heating	£312	£312	£0
Water heating	£683	£683	£0
Lighting	£47	£47	£0
Generated (PV)	-£166	-£166	£0
Total cost of fuels	£876	£876	£0
Total cost of uses	£876	£876	£0
Delivered energy	38 kWh/m²	38 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.5 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	63 kWh/m²	63 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	38.5100	(1b)	x 2.6700	(2b) =	102.8217	(1b) - (3b)
First floor	46.2700	(1c)	x 2.7000	(2c) =	124.9290	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		227.7507	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)

Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			25.5700	1.2357	31.5979			(27)
Heatloss Floor 1			38.5100	0.1200	4.6212	75.0000	2888.2500	(28a)
External Wall 1	86.3100	25.5700	60.7400	0.1400	8.5036	14.0000	850.3600	(29a)
Total net area of external elements Aum(A, m2)			124.8200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.7227			(33)
Party Wall 1			70.3500	0.0000	0.0000	20.0000	1407.0000	(32)
Wall to corridor			20.4300	0.0000	0.0000	20.0000	408.6000	(32)
Party Ceiling 1			38.9800			80.0000	3118.4000	(32b)
Internal Wall 1			188.6800			9.0000	1698.1200	(32c)
Internal Floor 1			46.2700			0.0000	0.0000	(32d)
Internal Ceiling 1			46.2700			9.0000	416.4300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10787.1600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		127.2371 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0200	0.0500	0.5510
E4 Jamb	30.1500	0.0500	1.5075
E5 Ground floor (normal)	12.9600	0.1600	2.0736
E18 Party wall between dwellings	6.0700	0.0600	0.3642
P1 Party wall - Ground floor	14.4100	0.0800	1.1528
E6 Intermediate floor within a dwelling	15.4800	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	15.4800	0.0000	0.0000
E16 Corner (normal)	6.0700	0.0900	0.5463

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.1954 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	50.9181 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.7399	22.5003	22.2608	21.0630	20.8234	19.6256	19.6256	19.3860	20.1047	20.8234	21.3025	21.7816	(38)
Heat transfer coeff	73.6580	73.4185	73.1789	71.9811	71.7415	70.5437	70.5437	70.3041	71.0228	71.7415	72.2206	72.6998	(39)
Average = Sum(39)m / 12 =												71.9212	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8688	0.8660	0.8632	0.8490	0.8462	0.8321	0.8321	0.8293	0.8377	0.8462	0.8519	0.8575	(40)
HLP (average)												0.8483	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.5473 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	92.0289	90.6458	88.6305	84.7746	81.9290	78.7556	76.9518	78.9519	81.1443	84.5516	88.4904	91.6763	(42a)
Hot water usage for baths	28.9053	28.4761	27.8715	26.7569	25.9223	24.9968	24.4969	25.0972	25.7508	26.7411	27.8787	28.8076	(42b)
Hot water usage for other uses	40.7172	39.2366	37.7560	36.2753	34.7947	33.3141	33.3141	34.7947	36.2753	37.7560	39.2366	40.7172	(42c)
Average daily hot water use (litres/day)												148.6630	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	161.6514	158.3585	154.2580	147.8068	142.6459	137.0665	134.7628	138.8438	143.1705	149.0487	155.6057	161.2011	(44)
Energy conte	256.0163	225.5004	237.0888	202.3401	192.0289	168.5392	162.9840	171.9177	176.5436	202.2576	221.6888	252.4020	(45)
Energy content (annual)										Total = Sum(45)m =		2469.3073	
Distribution loss (46)m = 0.15 x (45)m	38.4024	33.8251	35.5633	30.3510	28.8043	25.2809	24.4476	25.7876	26.4815	30.3386	33.2533	37.8603	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	276.9971	244.4508	258.0696	222.6441	213.0097	188.8432	183.9648	192.8985	196.8476	223.2384	241.9928	273.3828	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.9971	244.4508	258.0696	222.6441	213.0097	188.8432	183.9648	192.8985	196.8476	223.2384	241.9928	273.3828	(64)
										Total per year (kWh/year) = Sum(64)m =		2716.3393	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	101.9101	90.1392	95.6167	83.5213	80.6342	72.2825	70.9768	73.9473	74.9439	84.0353	89.9547	100.7083	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	152.8398	152.8398	152.8398	152.8398	152.8398	152.8398	152.8398	152.8398	152.8398	152.8398	152.8398	152.8398	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.3763	23.4272	19.0523	14.4238	10.7820	9.1026	9.8357	12.7848	17.1597	21.7882	25.4300	27.1094	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	342.0005	345.5494	336.6063	317.5675	293.5344	270.9467	255.8568	252.3079	261.2510	280.2898	304.3228	326.9105	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.8313	52.8313	52.8313	52.8313	52.8313	52.8313	52.8313	52.8313	52.8313	52.8313	52.8313	52.8313	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-101.8932	-101.8932	-101.8932	-101.8932	-101.8932	-101.8932	-101.8932	-101.8932	-101.8932	-101.8932	-101.8932	-101.8932	(71)
Water heating gains (Table 5)													
	136.9759	134.1357	128.5170	116.0018	108.3794	100.3923	95.3989	99.3915	104.0888	112.9507	124.9371	135.3606	(72)
Total internal gains													
	609.1307	606.8903	587.9535	551.7710	516.4737	484.2196	464.8693	468.2620	486.2774	518.8066	558.4679	593.1585	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	11.8100	36.7938	0.6300	0.8270	0.7700	156.8932	(77)
Southwest	13.7600	36.7938	0.6300	0.8270	0.7700	182.7986	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	339.6918	578.6208	791.6942	980.9475	1098.7429	1090.7974	1051.6451	963.7644	857.2374	639.4992	406.8725	290.7054	(83)
Total gains	948.8224	1185.5110	1379.6477	1532.7185	1615.2166	1575.0170	1516.5144	1432.0265	1343.5148	1158.3058	965.3404	883.8639	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.6803	40.8131	40.9467	41.6281	41.7671	42.4763	42.4763	42.6210	42.1897	41.7671	41.4900	41.2166	
alpha	3.7120	3.7209	3.7298	3.7752	3.7845	3.8318	3.8318	3.8414	3.8126	3.7845	3.7660	3.7478	
util living area	0.8764	0.7870	0.6753	0.5371	0.4044	0.2849	0.2043	0.2253	0.3598	0.5947	0.8054	0.8952	(86)
MIT	20.1011	20.4378	20.7076	20.8916	20.9682	20.9939	20.9987	20.9981	20.9847	20.8700	20.4865	20.0263	(87)
Th 2	20.1941	20.1965	20.1989	20.2110	20.2135	20.2256	20.2256	20.2281	20.2208	20.2135	20.2086	20.2038	(88)
util rest of house	0.8618	0.7663	0.6491	0.5072	0.3721	0.2510	0.1685	0.1877	0.3206	0.5585	0.7824	0.8823	(89)
MIT 2	19.1723	19.5750	19.8890	20.1038	20.1853	20.2212	20.2249	20.2270	20.2091	20.0887	19.6515	19.0893	(90)
Living area fraction									fLA = Living area / (4) =			0.3094	(91)
MIT	19.4596	19.8419	20.1423	20.3475	20.4275	20.4602	20.4643	20.4656	20.4490	20.3304	19.9099	19.3792	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4596	19.8419	20.1423	20.3475	20.4275	20.4602	20.4643	20.4656	20.4490	20.3304	19.9099	19.3792	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8467	0.7566	0.6472	0.5124	0.3810	0.2613	0.1796	0.1993	0.3321	0.5640	0.7731	0.8670	(94)
Useful gains	803.4139	896.9407	892.9491	785.4192	615.3897	411.5881	272.2926	285.3580	446.2375	653.2924	746.2598	766.3099	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1116.6286	1097.0146	998.3262	824.0043	626.1241	413.4033	272.6043	285.8270	450.9265	698.0731	925.1359	1103.5248	(97)
Space heating kWh	233.0318	134.4497	78.4006	27.7813	7.9864	0.0000	0.0000	0.0000	0.0000	33.3168	128.7908	250.8879	(98a)
Space heating requirement - total per year (kWh/year)												894.6451	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	233.0318	134.4497	78.4006	27.7813	7.9864	0.0000	0.0000	0.0000	0.0000	33.3168	128.7908	250.8879	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												894.6451	
Space heating per m2											(98c) / (4) =	10.5525	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	233.0318	134.4497	78.4006	27.7813	7.9864	0.0000	0.0000	0.0000	0.0000	33.3168	128.7908	250.8879	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	233.0318	134.4497	78.4006	27.7813	7.9864	0.0000	0.0000	0.0000	0.0000	33.3168	128.7908	250.8879	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.9971	244.4508	258.0696	222.6441	213.0097	188.8432	183.9648	192.8985	196.8476	223.2384	241.9928	273.3828	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	276.9971	244.4508	258.0696	222.6441	213.0097	188.8432	183.9648	192.8985	196.8476	223.2384	241.9928	273.3828	(219)
Space cooling fuel requirement													

(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	17.5102	15.8157	17.5102	16.9454	17.5102	16.9454	17.5102	17.5102	16.9454	17.5102	16.9454	17.5102	(231)
Lighting	23.0871	18.5213	16.6764	12.2178	9.4374	7.7104	8.6091	11.1905	14.5353	19.0711	21.5407	23.7287	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-20.4624	-32.3772	-52.1532	-64.8758	-75.4292	-72.1993	-71.0498	-64.2488	-52.6470	-39.0007	-23.4883	-17.2570	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.7824	-9.1858	-21.0908	-36.0726	-51.1279	-52.8387	-52.0877	-42.2189	-28.8746	-14.8467	-5.4989	-2.8707	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	894.6451	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2716.3393	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	206.1690	(230a)
Total electricity for the above, kWh/year	206.1690	(231)
Electricity for lighting (calculated in Appendix L)	186.3258	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-905.6843	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3097.7950	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	894.6451	16.4900	147.5270	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2716.3393	16.4900	447.9243	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	206.1690	16.4900	33.9973	(249)
Energy for lighting	186.3258	16.4900	30.7251	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-585.1886	16.4900	-96.4976	
PV Unit electricity exported	-320.4957	5.5900	-17.9157	
Total			-114.4133	(252)
Total energy cost			545.7604	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.5139	(257)
SAP value		75.4597	
SAP rating (Section 12)		75	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	894.6451	0.1580	141.3916	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2716.3393	0.1413	383.8667	(264)
Space and water heating			525.2583	(265)
Pumps, fans and electric keep-hot	206.1690	0.1387	28.5982	(267)
Energy for lighting	186.3258	0.1443	26.8926	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-585.1886	0.1325	-77.5620	
PV Unit electricity exported	-320.4957	0.1227	-39.3314	
Total			-116.8934	(269)
Total CO2, kg/year			463.8557	(272)
CO2 emissions per m2			5.4700	(273)
EI value			95.2106	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	38.5100 (1b)	x	2.6700 (2b)	=	102.8217	(1b) - (3b)
First floor	46.2700 (1c)	x	2.7000 (2c)	=	124.9290	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	227.7507	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			25.5700	1.2357	31.5979			(27)
Heatloss Floor 1			38.5100	0.1200	4.6212	75.0000	2888.2500	(28a)
External Wall 1	86.3100	25.5700	60.7400	0.1400	8.5036	14.0000	850.3600	(29a)
Total net area of external elements Aum(A, m2)			124.8200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.7227			(33)
Party Wall 1			70.3500	0.0000	0.0000	20.0000	1407.0000	(32)
Wall to corridor			20.4300	0.0000	0.0000	20.0000	408.6000	(32)
Party Ceiling 1			38.9800			80.0000	3118.4000	(32b)
Internal Wall 1			188.6800			9.0000	1698.1200	(32c)
Internal Floor 1			46.2700			0.0000	0.0000	(32d)
Internal Ceiling 1			46.2700			9.0000	416.4300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10787.1600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		127.2371 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0200	0.0500	0.5510
E4 Jamb	30.1500	0.0500	1.5075
E5 Ground floor (normal)	12.9600	0.1600	2.0736
E18 Party wall between dwellings	6.0700	0.0600	0.3642
P1 Party wall - Ground floor	14.4100	0.0800	1.1528
E6 Intermediate floor within a dwelling	15.4800	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	15.4800	0.0000	0.0000
E16 Corner (normal)	6.0700	0.0900	0.5463

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.1954 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	50.9181 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.9795	22.9795	22.5003	21.0630	20.8234	19.8651	19.3860	19.3860	20.3443	21.5421	22.0212	21.7816	(38)
Heat transfer coeff	73.8976	73.8976	73.4185	71.9811	71.7415	70.7832	70.3041	70.3041	71.2624	72.4602	72.9393	72.6998	(39)

Average = Sum(39)m / 12 =	72.1408

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8716	0.8716	0.8660	0.8490	0.8462	0.8349	0.8293	0.8293	0.8406	0.8547	0.8603	0.8575	(40)
HLP (average)												0.8509	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.5473 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
92.0289	90.6458	88.6305	84.7746	81.9290	78.7556	76.9518	78.9519	81.1443	84.5516	88.4904	91.6763	(42a)

Hot water usage for baths

	28.9053	28.4761	27.8715	26.7569	25.9223	24.9968	24.4969	25.0972	25.7508	26.7411	27.8787	28.8076 (42b)
Hot water usage for other uses												
	40.7172	39.2366	37.7560	36.2753	34.7947	33.3141	33.3141	34.7947	36.2753	37.7560	39.2366	40.7172 (42c)
Average daily hot water use (litres/day)												148.6630 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	161.6514	158.3585	154.2580	147.8068	142.6459	137.0665	134.7628	138.8438	143.1705	149.0487	155.6057	161.2011	(44)
Energy conte	256.0163	225.5004	237.0888	202.3401	192.0289	168.5392	162.9840	171.9177	176.5436	202.2576	221.6888	252.4020	(45)
Energy content (annual)										Total = Sum(45)m =		2469.3073	
Distribution loss (46)m = 0.15 x (45)m													
	38.4024	33.8251	35.5633	30.3510	28.8043	25.2809	24.4476	25.7876	26.4815	30.3386	33.2533	37.8603	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	276.9971	244.4508	258.0696	222.6441	213.0097	188.8432	183.9648	192.8985	196.8476	223.2384	241.9928	273.3828	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	276.9971	244.4508	258.0696	222.6441	213.0097	188.8432	183.9648	192.8985	196.8476	223.2384	241.9928	273.3828	(64)
										Total per year (kWh/year) = Sum(64)m =		2716.3393	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	101.9101	90.1392	95.6167	83.5213	80.6342	72.2825	70.9768	73.9473	74.9439	84.0353	89.9547	100.7083	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	152.8398	152.8398	152.8398	152.8398	152.8398	152.8398	152.8398	152.8398	152.8398	152.8398	152.8398	152.8398	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.3763	23.4272	19.0523	14.4238	10.7820	9.1026	9.8357	12.7848	17.1597	21.7882	25.4300	27.1094	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	342.0005	345.5494	336.6063	317.5675	293.5344	270.9467	255.8568	252.3079	261.2510	280.2898	304.3228	326.9105	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.8313	52.8313	52.8313	52.8313	52.8313	52.8313	52.8313	52.8313	52.8313	52.8313	52.8313	52.8313	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-101.8932	-101.8932	-101.8932	-101.8932	-101.8932	-101.8932	-101.8932	-101.8932	-101.8932	-101.8932	-101.8932	-101.8932	(71)
Water heating gains (Table 5)													
	136.9759	134.1357	128.5170	116.0018	108.3794	100.3923	95.3989	99.3915	104.0888	112.9507	124.9371	135.3606	(72)
Total internal gains													
	609.1307	606.8903	587.9535	551.7710	516.4737	484.2196	464.8693	468.2620	486.2774	518.8066	558.4679	593.1585	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	11.8100	33.4622	0.6300	0.8270	0.7700	142.6869	(77)
Southwest	13.7600	33.4622	0.6300	0.8270	0.7700	166.2465	(79)

Solar gains	308.9334	561.6457	803.1183	1046.7390	1160.5642	1119.8030	1093.0145	974.0618	861.8197	617.0184	380.2794	270.3735	(83)
Total gains	918.0641	1168.5359	1391.0718	1598.5100	1677.0379	1604.0226	1557.8838	1442.3239	1348.0971	1135.8250	938.7473	863.5320	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.5485	40.5485	40.8131	41.6281	41.7671	42.3325	42.6210	42.6210	42.0479	41.3528	41.0812	41.2166	
alpha	3.7032	3.7032	3.7209	3.7752	3.7845	3.8222	3.8414	3.8414	3.8032	3.7569	3.7387	3.7478	
util living area													
	0.8923	0.8083	0.7001	0.5540	0.4293	0.3404	0.2739	0.3001	0.4231	0.6463	0.8309	0.9080	(86)
MIT	19.9983	20.3475	20.6460	20.8698	20.9569	20.9859	20.9950	20.9930	20.9681	20.8081	20.3885	19.9278	(87)
Th 2	20.1917	20.1917	20.1965	20.2110	20.2135	20.2232	20.2281	20.2281	20.2183	20.2062	20.2013	20.2038	(88)
util rest of house													
	0.8792	0.7893	0.6757	0.5260	0.3988	0.3075	0.2397	0.2634	0.3853	0.6125	0.8102	0.8966	(89)
MIT 2	19.0445	19.4630	19.8152	20.0791	20.1736	20.2117	20.2246	20.2231	20.1913	20.0154	19.5295	18.9675	(90)
Living area fraction										fLA = Living area / (4) =		0.3094	(91)
MIT	19.3396	19.7367	20.0722	20.3237	20.4160	20.4513	20.4629	20.4613	20.4316	20.2607	19.7952	19.2646	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3396	19.7367	20.0722	20.3237	20.4160	20.4513	20.4629	20.4613	20.4316	20.2607	19.7952	19.2646	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8636	0.7778	0.6718	0.5301	0.4067	0.3172	0.2501	0.2745	0.3957	0.6149	0.7987	0.8810	(94)
Useful gains	792.8070	908.8859	934.5736	847.3714	682.1262	508.7677	389.6455	395.9565	533.4415	698.3908	749.7753	760.7952	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	1140.9510	1140.7332	1062.5271	894.2744	697.0380	513.2674	391.0959	398.0102	543.8491	765.2270	962.4526	1131.5423	(97)

Space heating kWh

259.0191	155.8014	95.1974	33.7701	11.0944	0.0000	0.0000	0.0000	0.0000	49.7261	153.1276	275.8358	(98a)

Space heating requirement - total per year (kWh/year) 1033.5719

Solar heating kWh

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)

Solar heating contribution - total per year (kWh/year) 0.0000

Space heating kWh

259.0191	155.8014	95.1974	33.7701	11.0944	0.0000	0.0000	0.0000	0.0000	49.7261	153.1276	275.8358	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 1033.5719

Space heating per m2 (98c) / (4) = 12.1912 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 100.0000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	259.0191	155.8014	95.1974	33.7701	11.0944	0.0000	0.0000	0.0000	0.0000	49.7261	153.1276	275.8358	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	259.0191	155.8014	95.1974	33.7701	11.0944	0.0000	0.0000	0.0000	0.0000	49.7261	153.1276	275.8358	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	276.9971	244.4508	258.0696	222.6441	213.0097	188.8432	183.9648	192.8985	196.8476	223.2384	241.9928	273.3828	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	276.9971	244.4508	258.0696	222.6441	213.0097	188.8432	183.9648	192.8985	196.8476	223.2384	241.9928	273.3828	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	17.5102	15.8157	17.5102	16.9454	17.5102	16.9454	17.5102	17.5102	16.9454	17.5102	16.9454	17.5102	(231)
Lighting	23.0871	18.5213	16.6764	12.2178	9.4374	7.7104	8.6091	11.1905	14.5353	19.0711	21.5407	23.7287	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-18.5566	-31.2493	-52.3722	-67.7726	-78.1786	-73.2282	-72.6624	-64.2680	-52.3048	-37.5529	-21.8999	-15.9638	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.1731	-8.4819	-20.8467	-38.6979	-54.4052	-54.2986	-54.3920	-42.2426	-28.5356	-13.6122	-4.7924	-2.4907	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year
Space heating fuel - main system 1 1033.5719 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 100.0000
Water heating fuel used 2716.3393 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)
mechanical ventilation fans (SFP = 0.7420) 206.1690 (230a)
Total electricity for the above, kWh/year 206.1690 (231)
Electricity for lighting (calculated in Appendix L) 186.3258 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation -911.9781 (233)
Wind generation 0.0000 (234)
Hydro-electric generation (Appendix N) 0.0000 (235a)
Electricity generated - Micro CHP (Appendix N) 0.0000 (235)
Appendix Q - special features
Energy saved or generated -0.0000 (236)
Energy used 0.0000 (237)
Total delivered energy for all uses 3230.4279 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1033.5719	25.1600	260.0467	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2716.3393	25.1600	683.4310	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	206.1690	25.1600	51.8721	(249)
Energy for lighting	186.3258	25.1600	46.8796	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-586.0094	25.1600	-147.4400	
PV Unit electricity exported	-325.9687	5.8100	-18.9388	
Total			-166.3788	(252)
Total energy cost			875.8506	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1033.5719	0.1576	162.8534	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2716.3393	0.1413	383.8667	(264)
Space and water heating			546.7201	(265)
Pumps, fans and electric keep-hot	206.1690	0.1387	28.5982	(267)
Energy for lighting	186.3258	0.1443	26.8926	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-586.0094	0.1322	-77.4969	
PV Unit electricity exported	-325.9687	0.1222	-39.8269	
Total			-117.3239	(269)
Total CO2, kg/year			484.8870	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1033.5719	1.5832	1636.3769	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2716.3393	1.5226	4135.7959	(278)
Space and water heating			5772.1728	(279)
Pumps, fans and electric keep-hot	206.1690	1.5128	311.8925	(281)
Energy for lighting	186.3258	1.5338	285.7927	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-586.0094	1.4886	-872.3530	
PV Unit electricity exported	-325.9687	0.4484	-146.1530	
Total			-1018.5060	(283)
Total Primary energy kWh/year			5351.3520	(286)

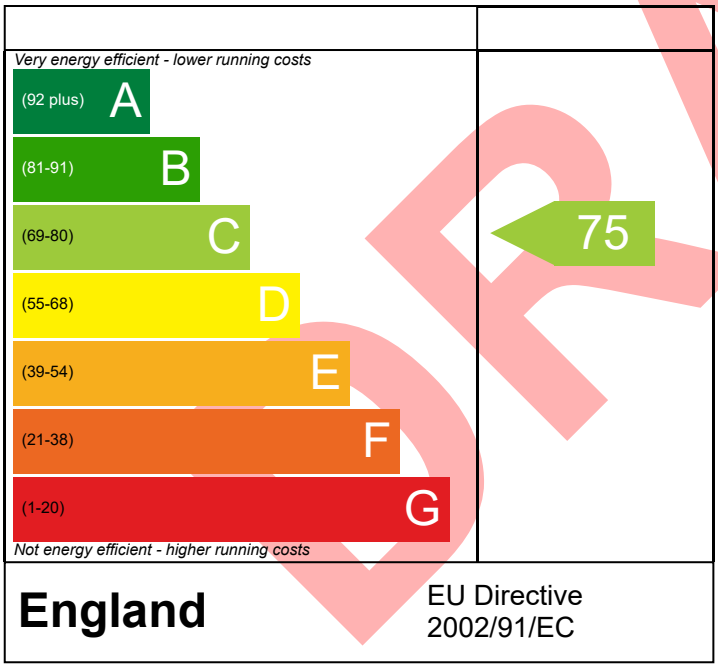
Predicted Energy Assessment

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	84.78 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

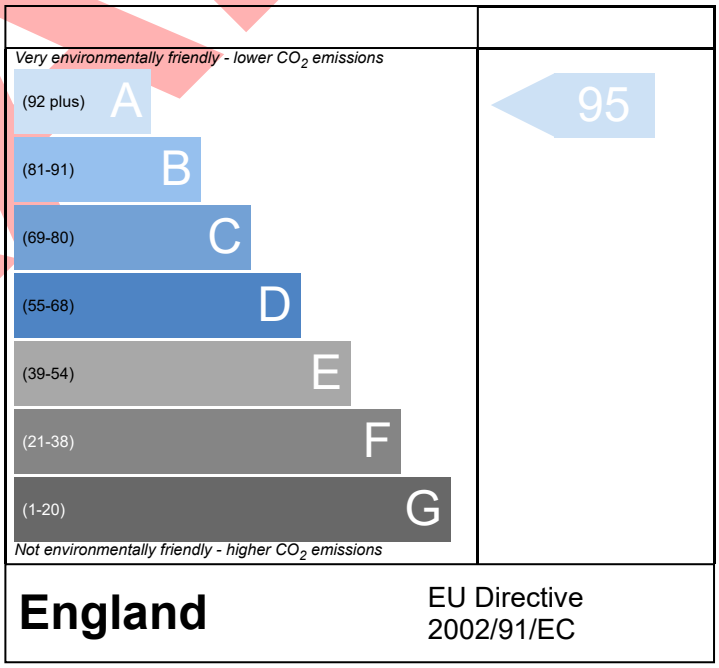
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:17

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	64 m^2
Site Reference	Unit 393 L03_Copy	Plot Reference	Unit 393 L03_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*12.3 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	6.25 kgCO_2/m^2	**OK**
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*66.47 kWh$_{PE}$/m^2*	
Dwelling primary energy	68.78 kWh$_{PE}$/m^2	**FAIL**
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*25.8 kWh/m^2*	
Dwelling fabric energy efficiency	28.7 kWh/m^2	**FAIL**

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	**OK**
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	**OK**
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	21.07	0.14 **(!)**
Party wall: Party Wall (1)	37.53	0 **(!)**
Party wall: Party Wall (2)	6.68	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	7.88	North East	0.83	1.3
N, Opening Type 1	2.11	North	0.83	1.3
NW, Opening Type 1	11.81	North West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.82 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 393 L03_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 393 L03_Copy	**Prop Type Ref**	Unit 411 L02
Property			

SAP Rating	76 C	**DER**	6.25	**TER**	12.30
Environmental	95 A	**% DER < TER**			49.19
CO_2 Emissions (t/year)	0.4	**DFEE**	28.70	**TFEE**	25.80
Compliance Check	See BREL	**% DFEE < TFEE**			-11.22
% DPER < TPER	-3.48	**DPER**	68.78	**TPER**	66.47

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.6600 (1b)	x	2.4000 (2b)	=	152.7840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.6600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	152.7840	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			21.8000	1.2357	26.9392			(27)
External Wall 1	42.8700	21.8000	21.0700	0.1400	2.9498	14.0000	294.9800	(29a)
Total net area of external elements Aum(A, m2)			42.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.8890			(33)
Party Wall 1			37.5300	0.0000	0.0000	20.0000	750.6000	(32)
Wall to corridor			6.6800	0.0000	0.0000	20.0000	133.6000	(32)
Party Floor 1			63.6600			80.0000	5092.8000	(32d)
Party Ceiling 1			63.6600			80.0000	5092.8000	(32b)
Internal Wall 1			123.2200			9.0000	1108.9800	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12473.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		195.9434 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	9.3800	0.0500	0.4690

E4 Jamb	27.8400	0.0500	1.3920	
E7 Party floor between dwellings (in blocks of flats)	15.8700	0.0700	1.1109	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3700	0.0000	0.0000	
E16 Corner (normal)	5.4000	0.0900	0.4860	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.7819 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 33.6709 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.2548	15.0941	14.9334	14.1298	13.9691	13.1656	13.1656	13.0049	13.4870	13.9691	14.2906	14.6120	(38)
Heat transfer coeff	48.9257	48.7650	48.6043	47.8007	47.6400	46.8365	46.8365	46.6757	47.1579	47.6400	47.9614	48.2828	(39)
Average = Sum(39)m / 12 =												47.7605	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7685	0.7660	0.7635	0.7509	0.7484	0.7357	0.7357	0.7332	0.7408	0.7484	0.7534	0.7584	(40)
HLP (average)												0.7502	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0830 (42)

Hot water usage for mixer showers

81.3240	80.1018	78.3209	74.9135	72.3989	69.5946	68.0007	69.7681	71.7056	74.7165	78.1971	81.0124	(42a)

Hot water usage for baths

25.5574	25.1778	24.6433	23.6578	22.9198	22.1016	21.6596	22.1903	22.7682	23.6438	24.6497	25.4710	(42b)

Hot water usage for other uses

35.9620	34.6543	33.3466	32.0389	30.7312	29.4235	29.4235	30.7312	32.0389	33.3466	34.6543	35.9620	(42c)

Average daily hot water use (litres/day) 131.3665 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	142.8434	139.9340	136.3109	130.6102	126.0499	121.1197	119.0838	122.6897	126.5127	131.7069	137.5011	142.4454	(44)
Energy conte	226.2290	199.2641	209.5047	178.7988	169.6874	148.9308	144.0215	151.9154	156.0028	178.7250	195.8955	223.0351	(45)
Energy content (annual)										Total = Sum(45)m =		2182.0102	
Distribution loss (46)m = 0.15 x (45)m	33.9344	29.8896	31.4257	26.8198	25.4531	22.3396	21.6032	22.7873	23.4004	26.8088	29.3843	33.4553	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
									Total per year (kWh/year) = Sum(64)m =		2429.0422	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

92.0058	81.4156	86.4450	75.6938	73.2057	65.7627	64.6718	67.2965	68.1141	76.2107	81.3784	90.9438	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.9586	18.6152	15.1389	11.4611	8.5673	7.2329	7.8154	10.1588	13.6351	17.3128	20.2066	21.5411	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	271.7527	274.5726	267.4664	252.3383	233.2416	215.2935	203.3031	200.4831	207.5893	222.7175	241.8141	259.7622	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	(71)
Water heating gains (Table 5)	123.6637	121.1542	116.1895	105.1303	98.3948	91.3371	86.9244	90.4523	94.6030	102.4338	113.0256	122.2363	(72)
Total internal gains	507.6160	505.5831	490.0359	460.1707	431.4448	405.1046	389.2840	392.3353	407.0684	433.7051	466.2874	494.7806	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1100	10.6334	0.6300	0.8270	0.7700	8.1009	(74)
Northeast	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(75)
Northwest	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(81)

Solar gains	88.3144	178.7581	320.4794	525.3714	706.3245	753.2685	704.5544	561.4605	390.0832	217.9657	110.9228	72.2597	(83)
Total gains	595.9304	684.3412	810.5153	985.5421	1137.7693	1158.3731	1093.8384	953.7958	797.1516	651.6708	577.2102	567.0403	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.8203	71.0537	71.2887	72.4871	72.7316	73.9794	73.9794	74.2341	73.4752	72.7316	72.2442	71.7632	
alpha	5.7214	5.7369	5.7526	5.8325	5.8488	5.9320	5.9320	5.9489	5.8983	5.8488	5.8163	5.7842	
util living area	0.9495	0.9033	0.7864	0.5758	0.3884	0.2587	0.1884	0.2251	0.4070	0.7170	0.9072	0.9584	(86)
MIT	20.4430	20.6297	20.8505	20.9756	20.9976	20.9998	21.0000	20.9999	20.9978	20.9371	20.6818	20.4051	(87)
Th 2	20.2807	20.2829	20.2851	20.2961	20.2983	20.3094	20.3094	20.3116	20.3050	20.2983	20.2939	20.2895	(88)
util rest of house	0.9400	0.8877	0.7604	0.5448	0.3594	0.2308	0.1588	0.1914	0.3664	0.6785	0.8895	0.9504	(89)
MIT 2	19.6501	19.8768	20.1321	20.2738	20.2964	20.3093	20.3094	20.3116	20.3035	20.2415	19.9531	19.6111	(90)
Living area fraction										fLA = Living area / (4) =		0.3699	(91)
MIT	19.9434	20.1553	20.3979	20.5334	20.5558	20.5647	20.5649	20.5662	20.5604	20.4988	20.2227	19.9048	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9434	20.1553	20.3979	20.5334	20.5558	20.5647	20.5649	20.5662	20.5604	20.4988	20.2227	19.9048	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9350	0.8847	0.7647	0.5553	0.3701	0.2411	0.1698	0.2039	0.3814	0.6898	0.8875	0.9454	(94)
Useful gains	557.2083	605.4138	619.7693	547.3032	421.0875	279.3214	185.6954	194.4496	304.0092	449.5203	512.2933	536.1066	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	765.3659	743.9254	675.4971	556.0856	421.8901	279.3673	185.6996	194.4617	304.6569	471.5806	629.3813	758.2722	(97)
Space heating kWh	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(98a)
Space heating requirement - total per year (kWh/year)												562.3385	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												562.3385	
Space heating per m2										(98c) / (4) =		8.8335	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.0817	10.0092	11.0817	10.7242	11.0817	10.7242	11.0817	11.0817	10.7242	11.0817	10.7242	11.0817	(231)
Lighting	18.3449	14.7170	13.2510	9.7083	7.4989	6.1267	6.8408	8.8919	11.5497	15.1538	17.1162	18.8548	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.3302	-24.3862	-39.3596	-49.2100	-57.7415	-55.5822	-54.6983	-49.3462	-40.2733	-29.5092	-17.6479	-12.9166	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.7432	-6.5971	-15.2405	-26.0425	-36.6010	-37.6280	-37.0950	-30.0206	-20.4973	-10.6316	-3.9607	-2.0877	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	562.3385	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2429.0422	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	130.4775	(230a)
Total electricity for the above, kWh/year	130.4775	(231)
Electricity for lighting (calculated in Appendix L)	148.0540	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-675.1465	(233)
Wind generation	0.0000	(234)

Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2594.7657	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	562.3385	16.4900	92.7296	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	16.4900	400.5491	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	130.4775	16.4900	21.5157	(249)
Energy for lighting	148.0540	16.4900	24.4141	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.0013	16.4900	-73.5456	
PV Unit electricity exported	-229.1452	5.5900	-12.8092	
Total			-86.3548	(252)
Total energy cost			452.8537	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.5003	(257)
SAP value	75.6794	
SAP rating (Section 12)	76	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	562.3385	0.1589	89.3676	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2429.0422	0.1413	343.1917	(264)
Space and water heating			432.5592	(265)
Pumps, fans and electric keep-hot	130.4775	0.1387	18.0988	(267)
Energy for lighting	148.0540	0.1443	21.3688	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.0013	0.1324	-59.0465	
PV Unit electricity exported	-229.1452	0.1229	-28.1599	
Total			-87.2065	(269)
Total CO2, kg/year			384.8203	(272)
CO2 emissions per m2			6.0400	(273)
EI value			95.2544	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.6600 (1b)	x	2.4000 (2b)	=	152.7840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 63.6600						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	152.7840	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			21.8000	1.2357	26.9392			(27)
External Wall 1	42.8700	21.8000	21.0700	0.1400	2.9498	14.0000	294.9800	(29a)
Total net area of external elements Aum(A, m2)			42.8700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.8890			(33)
Party Wall 1			37.5300	0.0000	0.0000	20.0000	750.6000	(32)
Wall to corridor			6.6800	0.0000	0.0000	20.0000	133.6000	(32)
Party Floor 1			63.6600			80.0000	5092.8000	(32d)
Party Ceiling 1			63.6600			80.0000	5092.8000	(32b)
Internal Wall 1			123.2200			9.0000	1108.9800	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12473.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 195.9434 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	9.3800	0.0500	0.4690
E4 Jamb	27.8400	0.0500	1.3920
E7 Party floor between dwellings (in blocks of flats)	15.8700	0.0700	1.1109
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3700	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.7819 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 33.6709 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.4155	15.4155	15.0941	14.1298	13.9691	13.3263	13.0049	13.0049	13.6477	14.4513	14.7727	14.6120	(38)
Heat transfer coeff	49.0864	49.0864	48.7650	47.8007	47.6400	46.9972	46.6757	46.6757	47.3186	48.1221	48.4435	48.2828	(39)
Average = Sum(39)m / 12 =												47.9078	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7711	0.7711	0.7660	0.7509	0.7484	0.7383	0.7332	0.7332	0.7433	0.7559	0.7610	0.7584	(40)
HLP (average)												0.7526	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0830 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	81.3240	80.1018	78.3209	74.9135	72.3989	69.5946	68.0007	69.7681	71.7056	74.7165	78.1971	81.0124	(42a)
Hot water usage for baths	25.5574	25.1778	24.6433	23.6578	22.9198	22.1016	21.6596	22.1903	22.7682	23.6438	24.6497	25.4710	(42b)
Hot water usage for other uses	35.9620	34.6543	33.3466	32.0389	30.7312	29.4235	29.4235	30.7312	32.0389	33.3466	34.6543	35.9620	(42c)
Average daily hot water use (litres/day)												131.3665	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	142.8434	139.9340	136.3109	130.6102	126.0499	121.1197	119.0838	122.6897	126.5127	131.7069	137.5011	142.4454	(44)
Energy conte	226.2290	199.2641	209.5047	178.7988	169.6874	148.9308	144.0215	151.9154	156.0028	178.7250	195.8955	223.0351	(45)
Energy content (annual)										Total = Sum(45)m =		2182.0102	
Distribution loss (46)m = 0.15 x (45)m	33.9344	29.8896	31.4257	26.8198	25.4531	22.3396	21.6032	22.7873	23.4004	26.8088	29.3843	33.4553	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
									Total per year (kWh/year) = Sum(64)m =			2429.0422	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	92.0058	81.4156	86.4450	75.6938	73.2057	65.7627	64.6718	67.2965	68.1141	76.2107	81.3784	90.9438	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	20.9586	18.6152	15.1389	11.4611	8.5673	7.2329	7.8154	10.1588	13.6351	17.3128	20.2066	21.5411	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	271.7527	274.5726	267.4664	252.3383	233.2416	215.2935	203.3031	200.4831	207.5893	222.7175	241.8141	259.7622	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	(71)

Water heating gains (Table 5)

	123.6637	121.1542	116.1895	105.1303	98.3948	91.3371	86.9244	90.4523	94.6030	102.4338	113.0256	122.2363	(72)

Total internal gains

	507.6160	505.5831	490.0359	460.1707	431.4448	405.1046	389.2840	392.3353	407.0684	433.7051	466.2874	494.7806	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1100	9.5462	0.6300	0.8270	0.7700	7.2726	(74)
Northeast	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(75)
Northwest	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(81)

Solar gains	78.5852	169.1438	316.2472	546.8143	731.2676	760.0483	718.8368	554.5515	381.6735	204.7435	101.3144	65.8401	(83)
Total gains	586.2012	674.7269	806.2830	1006.9851	1162.7125	1165.1528	1108.1208	946.8868	788.7419	638.4486	567.6018	560.6207	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.5885	70.5885	71.0537	72.4871	72.7316	73.7264	74.2341	74.2341	73.2256	72.0029	71.5252	71.7632	
alpha	5.7059	5.7059	5.7369	5.8325	5.8488	5.9151	5.9489	5.9489	5.8817	5.8002	5.7683	5.7842	
util living area	0.9573	0.9201	0.8197	0.6065	0.4204	0.3144	0.2569	0.3054	0.4881	0.7768	0.9246	0.9649	(86)
MIT	20.3836	20.5593	20.8002	20.9657	20.9959	20.9994	20.9999	20.9996	20.9932	20.8936	20.6163	20.3459	(87)
Th 2	20.2785	20.2785	20.2829	20.2961	20.2983	20.3072	20.3116	20.3116	20.3027	20.2917	20.2873	20.2895	(88)
util rest of house	0.9492	0.9069	0.7967	0.5771	0.3923	0.2865	0.2279	0.2716	0.4478	0.7427	0.9098	0.9582	(89)
MIT 2	19.5748	19.7882	20.0732	20.2636	20.2949	20.3067	20.3115	20.3114	20.2976	20.1904	19.8693	19.5372	(90)
Living area fraction									fLA = Living area / (4) =			0.3699	(91)
MIT	19.8740	20.0735	20.3421	20.5233	20.5543	20.5630	20.5662	20.5660	20.5549	20.4505	20.1456	19.8364	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8740	20.0735	20.3421	20.5233	20.5543	20.5630	20.5662	20.5660	20.5549	20.4505	20.1456	19.8364	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9440	0.9027	0.7987	0.5867	0.4026	0.2968	0.2386	0.2841	0.4625	0.7507	0.9065	0.9532	(94)
Useful gains	553.3976	609.0788	643.9471	590.8262	468.0629	345.8541	264.4318	269.0226	364.7623	479.2565	514.5178	534.3769	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	784.1055	774.2617	718.8998	603.4044	469.4566	346.0392	264.4719	269.1309	366.9520	517.3378	656.1978	779.1096	(97)
Space heating kWh	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(98a)
Space heating requirement - total per year (kWh/year)												660.9309	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												660.9309	
Space heating per m2											(98c) / (4) =	10.3822	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
Efficiency of water heater												100.0000	(216)

(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.0817	10.0092	11.0817	10.7242	11.0817	10.7242	11.0817	11.0817	10.7242	11.0817	10.7242	11.0817	(231)
Lighting	18.3449	14.7170	13.2510	9.7083	7.4989	6.1267	6.8408	8.8919	11.5497	15.1538	17.1162	18.8548	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-13.8915	-23.5305	-39.5288	-51.3707	-59.7978	-56.3926	-55.9689	-49.3612	-40.0071	-28.3817	-16.4413	-11.9422	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.3070	-6.0873	-15.0525	-27.9982	-39.0374	-38.6728	-38.7444	-30.0375	-20.2557	-9.7595	-3.4566	-1.8147	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	660.9309	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2429.0422	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	130.4775	(230a)
Total electricity for the above, kWh/year	130.4775	(231)
Electricity for lighting (calculated in Appendix L)	148.0540	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-679.8382	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2688.6664	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	660.9309	25.1600	166.2902	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	25.1600	611.1470	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	130.4775	25.1600	32.8281	(249)
Energy for lighting	148.0540	25.1600	37.2504	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.6146	25.1600	-112.3682	
PV Unit electricity exported	-233.2236	5.8100	-13.5503	
Total			-125.9185	(252)
Total energy cost			721.5972	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	660.9309	0.1583	104.6387	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2429.0422	0.1413	343.1917	(264)
Space and water heating			447.8304	(265)
Pumps, fans and electric keep-hot	130.4775	0.1387	18.0988	(267)
Energy for lighting	148.0540	0.1443	21.3688	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.6146	0.1321	-58.9946	
PV Unit electricity exported	-233.2236	0.1224	-28.5364	
Total			-87.5310	(269)
Total CO2, kg/year			399.7670	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	660.9309	1.5860	1048.2442	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	1.5224	3698.0874	(278)
Space and water heating			4746.3316	(279)
Pumps, fans and electric keep-hot	130.4775	1.5128	197.3864	(281)
Energy for lighting	148.0540	1.5338	227.0901	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.6146	1.4881	-664.5888	
PV Unit electricity exported	-233.2236	0.4490	-104.7247	
Total			-769.3135	(283)
Total Primary energy kWh/year			4401.4946	(286)

SAP 10 EPC IMPROVEMENTS

Unit 393 L03_Copy

Current energy efficiency rating: C 76
Current environmental impact rating: A 95

N Solar water heating	Not applicable
U Solar photovoltaic panels	Not applicable
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 76
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£848	£848	£0
Space heating	£199	£199	£0
Water heating	£611	£611	£0
Lighting	£37	£37	£0
Generated (PV)	-£126	-£126	£0
Total cost of fuels	£722	£722	£0
Total cost of uses	£721	£721	£0
Delivered energy	42 kWh/m²	42 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	69 kWh/m²	69 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.6600 (1b)	x	2.4000 (2b)	=	152.7840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.6600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	152.7840	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			21.8000	1.2357	26.9392			(27)
External Wall 1	42.8700	21.8000	21.0700	0.1400	2.9498	14.0000	294.9800	(29a)
Total net area of external elements Aum(A, m2)			42.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.8890			(33)
Party Wall 1			37.5300	0.0000	0.0000	20.0000	750.6000	(32)
Wall to corridor			6.6800	0.0000	0.0000	20.0000	133.6000	(32)
Party Floor 1			63.6600			80.0000	5092.8000	(32d)
Party Ceiling 1			63.6600			80.0000	5092.8000	(32b)
Internal Wall 1			123.2200			9.0000	1108.9800	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12473.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 195.9434 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	9.3800	0.0500	0.4690
E4 Jamb	27.8400	0.0500	1.3920
E7 Party floor between dwellings (in blocks of flats)	15.8700	0.0700	1.1109
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3700	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.7819 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 33.6709 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.2548	15.0941	14.9334	14.1298	13.9691	13.1656	13.1656	13.0049	13.4870	13.9691	14.2906	14.6120	(38)
Heat transfer coeff	48.9257	48.7650	48.6043	47.8007	47.6400	46.8365	46.8365	46.6757	47.1579	47.6400	47.9614	48.2828	(39)

Average = Sum(39)m / 12 = 47.7605

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7685	0.7660	0.7635	0.7509	0.7484	0.7357	0.7357	0.7332	0.7408	0.7484	0.7534	0.7584	(40)
HLP (average)												0.7502	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0830 (42)
Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
81.3240	80.1018	78.3209	74.9135	72.3989	69.5946	68.0007	69.7681	71.7056	74.7165	78.1971	81.0124	(42a)

Hot water usage for baths

25.5574	25.1778	24.6433	23.6578	22.9198	22.1016	21.6596	22.1903	22.7682	23.6438	24.6497	25.4710	(42b)

Hot water usage for other uses

35.9620	34.6543	33.3466	32.0389	30.7312	29.4235	29.4235	30.7312	32.0389	33.3466	34.6543	35.9620	(42c)

Average daily hot water use (litres/day) 131.3665 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	142.8434	139.9340	136.3109	130.6102	126.0499	121.1197	119.0838	122.6897	126.5127	131.7069	137.5011	142.4454	(44)
Energy conte	226.2290	199.2641	209.5047	178.7988	169.6874	148.9308	144.0215	151.9154	156.0028	178.7250	195.8955	223.0351	(45)
Energy content (annual)										Total = Sum(45)m =		2182.0102	
Distribution loss (46)m = 0.15 x (45)m	33.9344	29.8896	31.4257	26.8198	25.4531	22.3396	21.6032	22.7873	23.4004	26.8088	29.3843	33.4553	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
										Total per year (kWh/year) = Sum(64)m =		2429.0422	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	92.0058	81.4156	86.4450	75.6938	73.2057	65.7627	64.6718	67.2965	68.1141	76.2107	81.3784	90.9438	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.9586	18.6152	15.1389	11.4611	8.5673	7.2329	7.8154	10.1588	13.6351	17.3128	20.2066	21.5411	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	271.7527	274.5726	267.4664	252.3383	233.2416	215.2935	203.3031	200.4831	207.5893	222.7175	241.8141	259.7622	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	(71)
Water heating gains (Table 5)	123.6637	121.1542	116.1895	105.1303	98.3948	91.3371	86.9244	90.4523	94.6030	102.4338	113.0256	122.2363	(72)

Total internal gains

	507.6160	505.5831	490.0359	460.1707	431.4448	405.1046	389.2840	392.3353	407.0684	433.7051	466.2874	494.7806 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1100	10.6334	0.6300	0.8270	0.7700	8.1009	(74)
Northeast	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(75)
Northwest	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(81)

Solar gains	88.3144	178.7581	320.4794	525.3714	706.3245	753.2685	704.5544	561.4605	390.0832	217.9657	110.9228	72.2597 (83)
Total gains	595.9304	684.3412	810.5153	985.5421	1137.7693	1158.3731	1093.8384	953.7958	797.1516	651.6708	577.2102	567.0403 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.8203	71.0537	71.2887	72.4871	72.7316	73.9794	73.9794	74.2341	73.4752	72.7316	72.2442	71.7632	
alpha	5.7214	5.7369	5.7526	5.8325	5.8488	5.9320	5.9320	5.9489	5.8983	5.8488	5.8163	5.7842	
util living area	0.9495	0.9033	0.7864	0.5758	0.3884	0.2587	0.1884	0.2251	0.4070	0.7170	0.9072	0.9584	(86)
MIT	20.4430	20.6297	20.8505	20.9756	20.9976	20.9998	21.0000	20.9999	20.9978	20.9371	20.6818	20.4051	(87)
Th 2	20.2807	20.2829	20.2851	20.2961	20.2983	20.3094	20.3094	20.3116	20.3050	20.2983	20.2939	20.2895	(88)
util rest of house	0.9400	0.8877	0.7604	0.5448	0.3594	0.2308	0.1588	0.1914	0.3664	0.6785	0.8895	0.9504	(89)
MIT 2	19.6501	19.8768	20.1321	20.2738	20.2964	20.3093	20.3094	20.3116	20.3035	20.2415	19.9531	19.6111	(90)
Living area fraction									fLA = Living area / (4) =			0.3699	(91)
MIT	19.9434	20.1553	20.3979	20.5334	20.5558	20.5647	20.5649	20.5662	20.5604	20.4988	20.2227	19.9048	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9434	20.1553	20.3979	20.5334	20.5558	20.5647	20.5649	20.5662	20.5604	20.4988	20.2227	19.9048	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9350	0.8847	0.7647	0.5553	0.3701	0.2411	0.1698	0.2039	0.3814	0.6898	0.8875	0.9454	(94)
Useful gains	557.2083	605.4138	619.7693	547.3032	421.0875	279.3214	185.6954	194.4496	304.0092	449.5203	512.2933	536.1066	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	765.3659	743.9254	675.4971	556.0856	421.8901	279.3673	185.6996	194.4617	304.6569	471.5806	629.3813	758.2722	(97)
Space heating kWh	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(98a)
Space heating requirement - total per year (kWh/year)												562.3385	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												562.3385	
Space heating per m2											(98c) / (4) =	8.8335	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.0817	10.0092	11.0817	10.7242	11.0817	10.7242	11.0817	11.0817	10.7242	11.0817	10.7242	11.0817	(231)
Lighting	18.3449	14.7170	13.2510	9.7083	7.4989	6.1267	6.8408	8.8919	11.5497	15.1538	17.1162	18.8548	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.3302	-24.3862	-39.3596	-49.2100	-57.7415	-55.5822	-54.6983	-49.3462	-40.2733	-29.5092	-17.6479	-12.9166	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													

(233b)m	-2.7432	-6.5971	-15.2405	-26.0425	-36.6010	-37.6280	-37.0950	-30.0206	-20.4973	-10.6316	-3.9607	-2.0877	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	562.3385	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2429.0422	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	130.4775	(230a)
Total electricity for the above, kWh/year	130.4775	(231)
Electricity for lighting (calculated in Appendix L)	148.0540	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-675.1465	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2594.7657	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	562.3385	16.4900	92.7296	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	16.4900	400.5491	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	130.4775	16.4900	21.5157	(249)
Energy for lighting	148.0540	16.4900	24.4141	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.0013	16.4900	-73.5456	
PV Unit electricity exported	-229.1452	5.5900	-12.8092	
Total			-86.3548	(252)
Total energy cost			452.8537	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.5003	(257)
SAP value		75.6794	
SAP rating (Section 12)		76	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	562.3385	0.1589	89.3676	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2429.0422	0.1413	343.1917	(264)
Space and water heating			432.5592	(265)
Pumps, fans and electric keep-hot	130.4775	0.1387	18.0988	(267)
Energy for lighting	148.0540	0.1443	21.3688	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.0013	0.1324	-59.0465	
PV Unit electricity exported	-229.1452	0.1229	-28.1599	
Total			-87.2065	(269)
Total CO2, kg/year			384.8203	(272)
CO2 emissions per m2			6.0400	(273)
EI value			95.2544	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		63.6600 (1b)	x	2.4000 (2b)	=	152.7840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.6600						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	152.7840	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			21.8000	1.2357	26.9392			(27)
External Wall 1	42.8700	21.8000	21.0700	0.1400	2.9498	14.0000	294.9800	(29a)
Total net area of external elements Aum(A, m2)			42.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.8890			(33)
Party Wall 1			37.5300	0.0000	0.0000	20.0000	750.6000	(32)
Wall to corridor			6.6800	0.0000	0.0000	20.0000	133.6000	(32)
Party Floor 1			63.6600			80.0000	5092.8000	(32d)
Party Ceiling 1			63.6600			80.0000	5092.8000	(32b)
Internal Wall 1			123.2200			9.0000	1108.9800	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12473.7600	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	195.9434	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	9.3800	0.0500	0.4690
E4 Jamb	27.8400	0.0500	1.3920
E7 Party floor between dwellings (in blocks of flats)	15.8700	0.0700	1.1109
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3700	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	3.7819	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	33.6709	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.4155	15.4155	15.0941	14.1298	13.9691	13.3263	13.0049	13.0049	13.6477	14.4513	14.7727	14.6120	(38)
Heat transfer coeff	49.0864	49.0864	48.7650	47.8007	47.6400	46.9972	46.6757	46.6757	47.3186	48.1221	48.4435	48.2828	(39)
Average = Sum(39)m / 12 =												47.9078	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7711	0.7711	0.7660	0.7509	0.7484	0.7383	0.7332	0.7332	0.7433	0.7559	0.7610	0.7584	(40)
HLP (average)												0.7526	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0830	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
81.3240	80.1018	78.3209	74.9135	72.3989	69.5946	68.0007	69.7681	71.7056	74.7165	78.1971	81.0124	(42a)

Hot water usage for baths

25.5574	25.1778	24.6433	23.6578	22.9198	22.1016	21.6596	22.1903	22.7682	23.6438	24.6497	25.4710	(42b)

Hot water usage for other uses

35.9620	34.6543	33.3466	32.0389	30.7312	29.4235	29.4235	30.7312	32.0389	33.3466	34.6543	35.9620	(42c)

Average daily hot water use (litres/day)	131.3665	(43)

Daily hot water use

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
142.8434	139.9340	136.3109	130.6102	126.0499	121.1197	119.0838	122.6897	126.5127	131.7069	137.5011	142.4454	(44)
Energy conte 226.2290	199.2641	209.5047	178.7988	169.6874	148.9308	144.0215	151.9154	156.0028	178.7250	195.8955	223.0351	(45)
Energy content (annual)										Total = Sum(45)m =		2182.0102	

Distribution loss (46)m = 0.15 x (45)m

33.9344	29.8896	31.4257	26.8198	25.4531	22.3396	21.6032	22.7873	23.4004	26.8088	29.3843	33.4553	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

Total storage loss													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
											Total per year (kWh/year) = Sum(64)m =	2429.0422	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000	(64a)
Heat gains from water heating, kWh/month													
	92.0058	81.4156	86.4450	75.6938	73.2057	65.7627	64.6718	67.2965	68.1141	76.2107	81.3784	90.9438	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.9586	18.6152	15.1389	11.4611	8.5673	7.2329	7.8154	10.1588	13.6351	17.3128	20.2066	21.5411	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	271.7527	274.5726	267.4664	252.3383	233.2416	215.2935	203.3031	200.4831	207.5893	222.7175	241.8141	259.7622	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	(71)
Water heating gains (Table 5)													
	123.6637	121.1542	116.1895	105.1303	98.3948	91.3371	86.9244	90.4523	94.6030	102.4338	113.0256	122.2363	(72)
Total internal gains													
	507.6160	505.5831	490.0359	460.1707	431.4448	405.1046	389.2840	392.3353	407.0684	433.7051	466.2874	494.7806	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1100	9.5462	0.6300	0.8270	0.7700	7.2726	(74)
Northeast	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(75)
Northwest	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(81)

Solar gains	78.5852	169.1438	316.2472	546.8143	731.2676	760.0483	718.8368	554.5515	381.6735	204.7435	101.3144	65.8401	(83)
Total gains	586.2012	674.7269	806.2830	1006.9851	1162.7125	1165.1528	1108.1208	946.8868	788.7419	638.4486	567.6018	560.6207	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.5885	70.5885	71.0537	72.4871	72.7316	73.7264	74.2341	74.2341	73.2256	72.0029	71.5252	71.7632	
alpha	5.7059	5.7059	5.7369	5.8325	5.8488	5.9151	5.9489	5.9489	5.8817	5.8002	5.7683	5.7842	
util living area													
	0.9573	0.9201	0.8197	0.6065	0.4204	0.3144	0.2569	0.3054	0.4881	0.7768	0.9246	0.9649	(86)
MIT	20.3836	20.5593	20.8002	20.9657	20.9959	20.9994	20.9999	20.9996	20.9932	20.8936	20.6163	20.3459	(87)
Th 2	20.2785	20.2785	20.2829	20.2961	20.2983	20.3072	20.3116	20.3116	20.3027	20.2917	20.2873	20.2895	(88)
util rest of house													
	0.9492	0.9069	0.7967	0.5771	0.3923	0.2865	0.2279	0.2716	0.4478	0.7427	0.9098	0.9582	(89)
MIT 2	19.5748	19.7882	20.0732	20.2636	20.2949	20.3067	20.3115	20.3114	20.2976	20.1904	19.8693	19.5372	(90)
Living area fraction										fLA = Living area / (4) =		0.3699	(91)
MIT	19.8740	20.0735	20.3421	20.5233	20.5543	20.5630	20.5662	20.5660	20.5549	20.4505	20.1456	19.8364	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8740	20.0735	20.3421	20.5233	20.5543	20.5630	20.5662	20.5660	20.5549	20.4505	20.1456	19.8364	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9440	0.9027	0.7987	0.5867	0.4026	0.2968	0.2386	0.2841	0.4625	0.7507	0.9065	0.9532	(94)
Useful gains	553.3976	609.0788	643.9471	590.8262	468.0629	345.8541	264.4318	269.0226	364.7623	479.2565	514.5178	534.3769	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	784.1055	774.2617	718.8998	603.4044	469.4566	346.0392	264.4719	269.1309	366.9520	517.3378	656.1978	779.1096	(97)
Space heating kWh													
	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(98a)
Space heating requirement - total per year (kWh/year)												660.9309	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												660.9309	
Space heating per m2											(98c) / (4) =	10.3822	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.0817	10.0092	11.0817	10.7242	11.0817	10.7242	11.0817	11.0817	10.7242	11.0817	10.7242	11.0817	(231)
Lighting	18.3449	14.7170	13.2510	9.7083	7.4989	6.1267	6.8408	8.8919	11.5497	15.1538	17.1162	18.8548	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-13.8915	-23.5305	-39.5288	-51.3707	-59.7978	-56.3926	-55.9689	-49.3612	-40.0071	-28.3817	-16.4413	-11.9422	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.3070	-6.0873	-15.0525	-27.9982	-39.0374	-38.6728	-38.7444	-30.0375	-20.2557	-9.7595	-3.4566	-1.8147	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												660.9309	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2429.0422	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)													
mechanical ventilation fans (SFP = 0.7000)												130.4775	(230a)
Total electricity for the above, kWh/year												130.4775	(231)
Electricity for lighting (calculated in Appendix L)												148.0540	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-679.8382	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2688.6664	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	660.9309	25.1600	166.2902	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	25.1600	611.1470	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	130.4775	25.1600	32.8281	(249)
Energy for lighting	148.0540	25.1600	37.2504	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.6146	25.1600	-112.3682	
PV Unit electricity exported	-233.2236	5.8100	-13.5503	
Total			-125.9185	(252)
Total energy cost			721.5972	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	660.9309	0.1583	104.6387	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2429.0422	0.1413	343.1917	(264)
Space and water heating			447.8304	(265)
Pumps, fans and electric keep-hot	130.4775	0.1387	18.0988	(267)
Energy for lighting	148.0540	0.1443	21.3688	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.6146	0.1321	-58.9946	
PV Unit electricity exported	-233.2236	0.1224	-28.5364	
Total			-87.5310	(269)
Total CO2, kg/year			399.7670	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	660.9309	1.5860	1048.2442	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	1.5224	3698.0874	(278)
Space and water heating			4746.3316	(279)
Pumps, fans and electric keep-hot	130.4775	1.5128	197.3864	(281)
Energy for lighting	148.0540	1.5338	227.0901	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.6146	1.4881	-664.5888	
PV Unit electricity exported	-233.2236	0.4490	-104.7247	
Total			-769.3135	(283)
Total Primary energy kWh/year			4401.4946	(286)

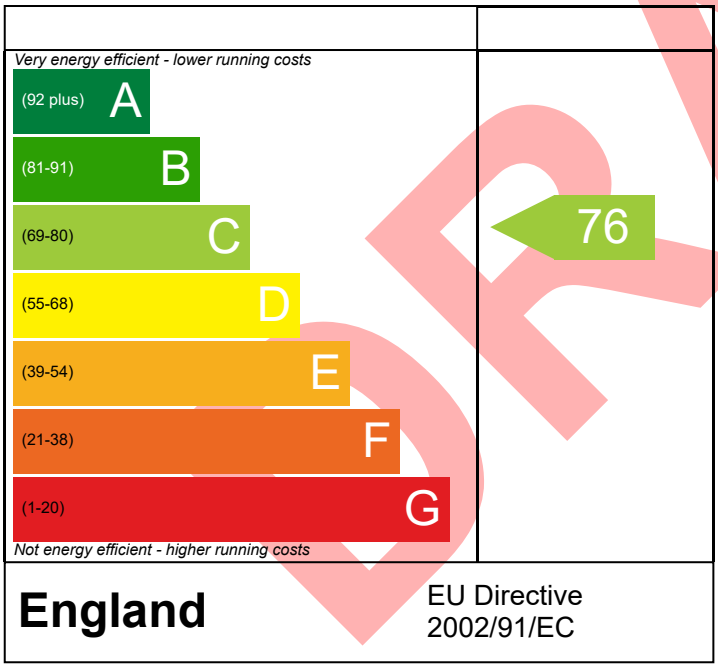
Predicted Energy Assessment

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	63.66 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

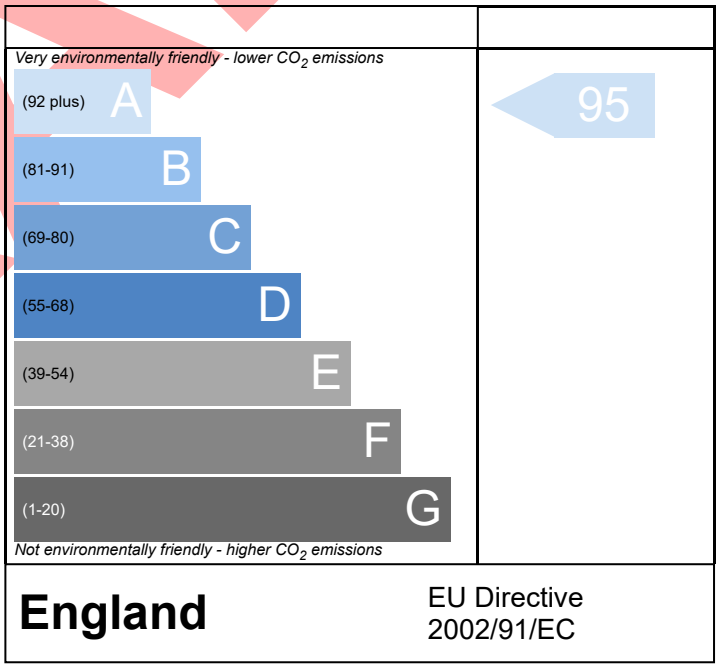
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:17

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	72 m^2
Site Reference	Unit 394 L03_Copy	Plot Reference	Unit 394 L03_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*10.45 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	4.68 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*56.41 kWh$_{PE}$/m^2*	
Dwelling primary energy	52.87 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*18.9 kWh/m^2*	
Dwelling fabric energy efficiency	17.8 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	16.81	0.14 **(!)**
Party wall: Party Wall (1)	41.71	0 **(!)**
Party wall: Party Wall (2)	22.81	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	11.81	North East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.93 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 394 L03_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 394 L03_Copy	**Prop Type Ref**	Unit 394 L03
Property			

SAP Rating	80 C	**DER**	4.68	**TER**	10.45
Environmental	96 A	**% DER < TER**			55.22
CO_2 Emissions (t/year)	0.33	**DFEE**	17.78	**TFEE**	18.90
Compliance Check	See BREL	**% DFEE < TFEE**			5.90
% DPER < TPER	6.27	**DPER**	52.87	**TPER**	56.41

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	71.6800 (1b)	x	2.4000 (2b)	=	172.0320	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.6800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	172.0320	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	28.6200	11.8100	16.8100	0.1400	2.3534	14.0000	235.3400	(29a)
Total net area of external elements Aum(A, m2)			28.6200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.9475			(33)
Party Wall 1			41.7100	0.0000	0.0000	20.0000	834.2000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			71.6800			80.0000	5734.4000	(32d)
Party Ceiling 1			71.6800			80.0000	5734.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 14231.4100	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.5409	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545

E4 Jamb	13.9200	0.0500	0.6960	
E7 Party floor between dwellings (in blocks of flats)	10.6000	0.0700	0.7420	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.9000	0.0000	0.0000	
E16 Corner (normal)	2.7000	0.0900	0.2430	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.2595 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 19.2070 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3623	16.1974	16.0324	15.2074	15.0424	14.2175	14.2175	14.0525	14.5475	15.0424	15.3724	15.7024	(38)
Heat transfer coeff	35.5693	35.4044	35.2394	34.4144	34.2494	33.4245	33.4245	33.2595	33.7545	34.2494	34.5794	34.9094	(39)
Average = Sum(39)m / 12 =												34.3732	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4962	0.4939	0.4916	0.4801	0.4778	0.4663	0.4663	0.4640	0.4709	0.4778	0.4824	0.4870	(40)
HLP (average)												0.4795	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2862 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	86.0089	84.7163	82.8328	79.2291	76.5696	73.6038	71.9181	73.7873	75.8363	79.0207	82.7018	85.6793	(42a)
Hot water usage for baths	27.0226	26.6213	26.0561	25.0141	24.2338	23.3686	22.9013	23.4625	24.0735	24.9993	26.0628	26.9312	(42b)
Hot water usage for other uses	38.0431	36.6597	35.2763	33.8929	32.5095	31.1262	31.1262	32.5095	33.8929	35.2763	36.6597	38.0431	(42c)
Average daily hot water use (litres/day)												138.9361	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.0745	147.9973	144.1652	138.1361	133.3130	128.0986	125.9455	129.7594	133.8028	139.2963	145.4243	150.6536	(44)
Energy conte	239.2651	210.7461	221.5766	189.1014	179.4649	157.5122	152.3202	160.6692	164.9922	189.0238	207.1836	235.8872	(45)
Energy content (annual)										Total = Sum(45)m =		2307.7426	
Distribution loss (46)m = 0.15 x (45)m	35.8898	31.6119	33.2365	28.3652	26.9197	23.6268	22.8480	24.1004	24.7488	28.3536	31.0775	35.3831	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)
										Total per year (kWh/year) = Sum(64)m =		2554.7746	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	96.3403	85.2334	90.4589	79.1194	76.4567	68.6160	67.4311	70.2071	71.1031	79.6351	85.1318	95.2171	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.3930	20.7775	16.8974	12.7924	9.5625	8.0730	8.7232	11.3387	15.2188	19.3238	22.5537	24.0432	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	300.2774	303.3934	295.5413	278.8252	257.7241	237.8920	224.6430	221.5270	229.3791	246.0952	267.1963	287.0284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	(71)
Water heating gains (Table 5)	129.4896	126.8354	121.5845	109.8881	102.7644	95.3000	90.6332	94.3644	98.7543	107.0364	118.2386	127.9800	(72)
Total internal gains	549.8877	547.7339	530.7508	498.2333	466.7786	437.9927	420.7271	423.9579	440.0799	469.1831	504.7163	535.7792	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(75)

Solar gains	48.1118	97.9329	176.4440	289.7718	389.5101	415.2590	388.4663	309.6898	214.9998	119.6818	60.5371	39.2905	(83)
Total gains	597.9995	645.6669	707.1948	788.0051	856.2887	853.2517	809.1933	733.6477	655.0797	588.8649	565.2534	575.0697	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	111.1398	111.6577	112.1805	114.8696	115.4229	118.2717	118.2717	118.8584	117.1155	115.4229	114.3215	113.2409	
alpha	8.4093	8.4438	8.4787	8.6580	8.6949	8.8848	8.8848	8.9239	8.8077	8.6949	8.6214	8.5494	
util living area													
	0.8907	0.8306	0.7092	0.5274	0.3719	0.2507	0.1817	0.2085	0.3555	0.6018	0.8105	0.9039	(86)
MIT	20.8722	20.9298	20.9803	20.9984	20.9999	21.0000	21.0000	21.0000	21.0000	20.9963	20.9530	20.8608	(87)
Th 2	20.5243	20.5264	20.5285	20.5391	20.5412	20.5518	20.5518	20.5539	20.5476	20.5412	20.5370	20.5327	(88)
util rest of house													
	0.8771	0.8135	0.6886	0.5076	0.3536	0.2332	0.1632	0.1883	0.3322	0.5761	0.7902	0.8914	(89)
MIT 2	20.3839	20.4516	20.5087	20.5376	20.5412	20.5518	20.5518	20.5539	20.5476	20.5379	20.4887	20.3786	(90)
Living area fraction										fLA = Living area / (4) =		0.4021	(91)
MIT	20.5802	20.6438	20.6983	20.7228	20.7256	20.7320	20.7320	20.7333	20.7295	20.7222	20.6754	20.5725	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5802	20.6438	20.6983	20.7228	20.7256	20.7320	20.7320	20.7333	20.7295	20.7222	20.6754	20.5725	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8788	0.8178	0.6961	0.5155	0.3610	0.2402	0.1707	0.1964	0.3416	0.5863	0.7964	0.8925	(94)
Useful gains	525.5185	528.0545	492.2508	406.2317	309.0939	204.9590	138.1105	144.1228	223.7621	345.2470	450.1599	513.2582	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	579.0763	557.4003	500.3404	406.8764	309.1219	204.9594	138.1105	144.1229	223.7735	346.6793	469.4288	571.5536	(97)
Space heating kWh	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(98a)
Space heating requirement - total per year (kWh/year)												124.3821	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												124.3821	
Space heating per m2											(98c) / (4) =	1.7352	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.2264	11.9464	13.2264	12.7997	13.2264	12.7997	13.2264	13.2264	12.7997	13.2264	12.7997	13.2264	(231)
Lighting	20.4758	16.4264	14.7902	10.8359	8.3700	6.8383	7.6354	9.9247	12.8912	16.9140	19.1043	21.0448	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-17.0008	-26.9528	-43.7049	-55.0326	-64.6365	-62.1981	-61.2076	-55.2744	-45.1885	-33.0016	-19.5873	-14.3353	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.4971	-8.1867	-18.2196	-30.3147	-42.3617	-43.5158	-42.8995	-34.7392	-23.7344	-12.5240	-4.9201	-2.6818	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												124.3821	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2554.7746	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)													
mechanical ventilation fans (SFP = 0.7420)												155.7302	(230a)
Total electricity for the above, kWh/year												155.7302	(231)
Electricity for lighting (calculated in Appendix L)												165.2510	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-765.7149	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)

Appendix Q - special features

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2234.4231	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	124.3821	16.4900	20.5106	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	16.4900	421.2823	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	155.7302	16.4900	25.6799	(249)
Energy for lighting	165.2510	16.4900	27.2499	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.1204	16.4900	-82.1401	
PV Unit electricity exported	-267.5945	5.5900	-14.9585	
Total			-97.0986	(252)
Total energy cost			397.6242	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2268	(257)
SAP value	80.1133	
SAP rating (Section 12)	80	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	124.3821	0.1604	19.9497	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2554.7746	0.1413	360.9927	(264)
Space and water heating			380.9424	(265)
Pumps, fans and electric keep-hot	155.7302	0.1387	21.6017	(267)
Energy for lighting	165.2510	0.1443	23.8508	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.1204	0.1323	-65.9162	
PV Unit electricity exported	-267.5945	0.1234	-33.0212	
Total			-98.9374	(269)
Total CO2, kg/year			327.4575	(272)
CO2 emissions per m2			4.5700	(273)
EI value			96.2393	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	71.6800	(1b)	x 2.4000	(2b) =	172.0320	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 71.6800						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		172.0320	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 = 0.0000	(6a)
Number of open flues	0 * 20 = 0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000	(6d)
Number of flues attached to other heater	0 * 35 = 0.0000	(6e)
Number of blocked chimneys	0 * 20 = 0.0000	(6f)
Number of intermittent extract fans	0 * 10 = 0.0000	(7a)
Number of passive vents	0 * 10 = 0.0000	(7b)
Number of flueless gas fires	0 * 40 = 0.0000	(7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000	(8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	3.0000	(17)
Infiltration rate	0.1500	(18)
Number of sides sheltered	3	(19)
Shelter factor (20) = 1 - [0.075 x (19)] =	0.7750	(20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	28.6200	11.8100	16.8100	0.1400	2.3534	14.0000	235.3400	(29a)
Total net area of external elements Aum(A, m2)			28.6200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.9475			(33)
Party Wall 1			41.7100	0.0000	0.0000	20.0000	834.2000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			71.6800			80.0000	5734.4000	(32d)
Party Ceiling 1			71.6800			80.0000	5734.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14231.4100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 198.5409 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	10.6000	0.0700	0.7420
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.9000	0.0000	0.0000
E16 Corner (normal)	2.7000	0.0900	0.2430

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 0.2595 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 19.2070 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.5273	16.5273	16.1974	15.2074	15.0424	14.3825	14.0525	14.0525	14.7124	15.5374	15.8674	15.7024	(38)
Heat transfer coeff	35.7343	35.7343	35.4044	34.4144	34.2494	33.5895	33.2595	33.2595	33.9195	34.7444	35.0744	34.9094	(39)

Average = Sum(39)m / 12 = 34.5244

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4985	0.4985	0.4939	0.4801	0.4778	0.4686	0.4640	0.4640	0.4732	0.4847	0.4893	0.4870	(40)
HLP (average)												0.4816	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2862 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	86.0089	84.7163	82.8328	79.2291	76.5696	73.6038	71.9181	73.7873	75.8363	79.0207	82.7018	85.6793	(42a)
Hot water usage for baths	27.0226	26.6213	26.0561	25.0141	24.2338	23.3686	22.9013	23.4625	24.0735	24.9993	26.0628	26.9312	(42b)
Hot water usage for other uses	38.0431	36.6597	35.2763	33.8929	32.5095	31.1262	31.1262	32.5095	33.8929	35.2763	36.6597	38.0431	(42c)

Average daily hot water use (litres/day) 138.9361 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.0745	147.9973	144.1652	138.1361	133.3130	128.0986	125.9455	129.7594	133.8028	139.2963	145.4243	150.6536	(44)
Energy conte	239.2651	210.7461	221.5766	189.1014	179.4649	157.5122	152.3202	160.6692	164.9922	189.0238	207.1836	235.8872	(45)

Energy content (annual) Total = Sum(45)m = 2307.7426

Distribution loss (46)m = 0.15 x (45)m	35.8898	31.6119	33.2365	28.3652	26.9197	23.6268	22.8480	24.1004	24.7488	28.3536	31.0775	35.3831	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)

Total per year (kWh/year) = Sum(64)m = 2554.7746 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	96.3403	85.2334	90.4589	79.1194	76.4567	68.6160	67.4311	70.2071	71.1031	79.6351	85.1318	95.2171	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.3930	20.7775	16.8974	12.7924	9.5625	8.0730	8.7232	11.3387	15.2188	19.3238	22.5537	24.0432	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	300.2774	303.3934	295.5413	278.8252	257.7241	237.8920	224.6430	221.5270	229.3791	246.0952	267.1963	287.0284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	(71)
Water heating gains (Table 5)													
	129.4896	126.8354	121.5845	109.8881	102.7644	95.3000	90.6332	94.3644	98.7543	107.0364	118.2386	127.9800	(72)
Total internal gains													
	549.8877	547.7339	530.7508	498.2333	466.7786	437.9927	420.7271	423.9579	440.0799	469.1831	504.7163	535.7792	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(75)

Solar gains	42.7730	92.6022	174.0550	301.5827	403.2921	419.0362	396.3745	305.8819	210.3213	112.3593	55.2465	35.7661	(83)
Total gains	592.6608	640.3361	704.8058	799.8160	870.0707	857.0289	817.1015	729.8397	650.4012	581.5423	559.9628	571.5453	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	110.6266	110.6266	111.6577	114.8696	115.4229	117.6907	118.8584	118.8584	116.5458	113.7786	112.7082	113.2409	
alpha	8.3751	8.3751	8.4438	8.6580	8.6949	8.8460	8.9239	8.9239	8.7697	8.5852	8.5139	8.5494	
util living area													
	0.9065	0.8593	0.7516	0.5619	0.4054	0.3057	0.2483	0.2825	0.4275	0.6674	0.8432	0.9182	(86)
MIT	20.8464	20.9031	20.9677	20.9971	20.9998	21.0000	21.0000	21.0000	20.9998	20.9906	20.9314	20.8348	(87)
Th 2	20.5222	20.5222	20.5264	20.5391	20.5412	20.5497	20.5539	20.5539	20.5455	20.5349	20.5306	20.5327	(88)
util rest of house													
	0.8943	0.8439	0.7321	0.5426	0.3873	0.2881	0.2301	0.2622	0.4039	0.6418	0.8246	0.9073	(89)
MIT 2	20.3514	20.4171	20.4931	20.5364	20.5411	20.5497	20.5539	20.5539	20.5453	20.5262	20.4588	20.3477	(90)
Living area fraction									fLA = Living area / (4) =			0.4021	(91)
MIT	20.5504	20.6125	20.6839	20.7216	20.7255	20.7307	20.7333	20.7333	20.7280	20.7130	20.6488	20.5436	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5504	20.6125	20.6839	20.7216	20.7255	20.7307	20.7333	20.7333	20.7280	20.7130	20.6488	20.5436	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8951	0.8469	0.7387	0.5502	0.3946	0.2951	0.2374	0.2704	0.4134	0.6517	0.8294	0.9075	(94)
Useful gains	530.4783	542.2746	520.6325	440.0970	343.3043	252.9499	194.0117	197.3368	268.8466	378.9737	464.4567	518.6920	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	594.9914	582.9178	534.0374	441.2484	343.3684	252.9535	194.0121	197.3380	268.9149	382.6385	492.7526	587.9989	(97)
Space heating kWh													
	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643	(98a)
Space heating requirement - total per year (kWh/year)												160.8238	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												160.8238	
Space heating per m2										(98c) / (4) =		2.2436	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(219)
Space cooling fuel requirement													

(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.2264	11.9464	13.2264	12.7997	13.2264	12.7997	13.2264	13.2264	12.7997	13.2264	12.7997	13.2264	(231)
Lighting	20.4758	16.4264	14.7902	10.8359	8.3700	6.8383	7.6354	9.9247	12.8912	16.9140	19.1043	21.0448	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.4126	-25.9729	-43.7522	-57.3553	-66.8995	-63.0965	-62.6159	-55.2911	-44.8919	-31.6377	-18.2309	-13.2576	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.9589	-7.6180	-18.1511	-32.6607	-45.1941	-44.7217	-44.8029	-34.7587	-23.4550	-11.6200	-4.3363	-2.3448	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	160.8238	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2554.7746	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	155.7302	(230a)
Total electricity for the above, kWh/year	155.7302	(231)
Electricity for lighting (calculated in Appendix L)	165.2510	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-771.0360	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2265.5437	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	160.8238	25.1600	40.4633	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	25.1600	642.7813	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	155.7302	25.1600	39.1817	(249)
Energy for lighting	165.2510	25.1600	41.5772	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.4140	25.1600	-125.4010	
PV Unit electricity exported	-272.6220	5.8100	-15.8393	
Total			-141.2403	(252)
Total energy cost			622.7632	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	160.8238	0.1598	25.6965	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2554.7746	0.1413	360.9927	(264)
Space and water heating			386.6891	(265)
Pumps, fans and electric keep-hot	155.7302	0.1387	21.6017	(267)
Energy for lighting	165.2510	0.1443	23.8508	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.4140	0.1320	-65.8025	
PV Unit electricity exported	-272.6220	0.1229	-33.5042	
Total			-99.3067	(269)
Total CO2, kg/year			332.8350	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	160.8238	1.5914	255.9292	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	1.5225	3889.6458	(278)
Space and water heating			4145.5750	(279)
Pumps, fans and electric keep-hot	155.7302	1.5128	235.5887	(281)
Energy for lighting	165.2510	1.5338	253.4676	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.4140	1.4878	-741.5395	
PV Unit electricity exported	-272.6220	0.4510	-122.9601	
Total			-864.4997	(283)
Total Primary energy kWh/year			3770.1316	(286)

SAP 10 EPC IMPROVEMENTS

Unit 394 L03_Copy

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 80
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£764	£764	£0
Space heating	£80	£80	£0
Water heating	£643	£643	£0
Lighting	£42	£42	£0
Generated (PV)	-£141	-£141	£0
Total cost of fuels	£623	£623	£0
Total cost of uses	£624	£624	£0
Delivered energy	32 kWh/m²	32 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	53 kWh/m²	53 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	71.6800 (1b)	x	2.4000 (2b)	=	172.0320	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.6800					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	172.0320	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	28.6200	11.8100	16.8100	0.1400	2.3534	14.0000	235.3400	(29a)
Total net area of external elements Aum(A, m2)			28.6200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.9475			(33)
Party Wall 1			41.7100	0.0000	0.0000	20.0000	834.2000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			71.6800			80.0000	5734.4000	(32d)
Party Ceiling 1			71.6800			80.0000	5734.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14231.4100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 198.5409 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	10.6000	0.0700	0.7420
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.9000	0.0000	0.0000
E16 Corner (normal)	2.7000	0.0900	0.2430

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.2595 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 19.2070 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3623	16.1974	16.0324	15.2074	15.0424	14.2175	14.2175	14.0525	14.5475	15.0424	15.3724	15.7024	(38)
Heat transfer coeff	35.5693	35.4044	35.2394	34.4144	34.2494	33.4245	33.4245	33.2595	33.7545	34.2494	34.5794	34.9094	(39)
Average = Sum(39)m / 12 =												34.3732	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4962	0.4939	0.4916	0.4801	0.4778	0.4663	0.4663	0.4640	0.4709	0.4778	0.4824	0.4870	(40)
HLP (average)												0.4795	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2862 (42)
Hot water usage for mixer showers

86.0089	84.7163	82.8328	79.2291	76.5696	73.6038	71.9181	73.7873	75.8363	79.0207	82.7018	85.6793	(42a)

Hot water usage for baths

27.0226	26.6213	26.0561	25.0141	24.2338	23.3686	22.9013	23.4625	24.0735	24.9993	26.0628	26.9312	(42b)

Hot water usage for other uses

38.0431	36.6597	35.2763	33.8929	32.5095	31.1262	31.1262	32.5095	33.8929	35.2763	36.6597	38.0431	(42c)

Average daily hot water use (litres/day) 138.9361 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.0745	147.9973	144.1652	138.1361	133.3130	128.0986	125.9455	129.7594	133.8028	139.2963	145.4243	150.6536	(44)
Energy conte	239.2651	210.7461	221.5766	189.1014	179.4649	157.5122	152.3202	160.6692	164.9922	189.0238	207.1836	235.8872	(45)
Energy content (annual)										Total = Sum(45)m =		2307.7426	
Distribution loss (46)m = 0.15 x (45)m	35.8898	31.6119	33.2365	28.3652	26.9197	23.6268	22.8480	24.1004	24.7488	28.3536	31.0775	35.3831	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)

Total per year (kWh/year) = Sum(64)m = 2554.7746 (64)
Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month

96.3403	85.2334	90.4589	79.1194	76.4567	68.6160	67.4311	70.2071	71.1031	79.6351	85.1318	95.2171	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.3930	20.7775	16.8974	12.7924	9.5625	8.0730	8.7232	11.3387	15.2188	19.3238	22.5537	24.0432	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	300.2774	303.3934	295.5413	278.8252	257.7241	237.8920	224.6430	221.5270	229.3791	246.0952	267.1963	287.0284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	(71)
Water heating gains (Table 5)	129.4896	126.8354	121.5845	109.8881	102.7644	95.3000	90.6332	94.3644	98.7543	107.0364	118.2386	127.9800	(72)
Total internal gains	549.8877	547.7339	530.7508	498.2333	466.7786	437.9927	420.7271	423.9579	440.0799	469.1831	504.7163	535.7792	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(75)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	48.1118	97.9329	176.4440	289.7718	389.5101	415.2590	388.4663	309.6898	214.9998	119.6818	60.5371	39.2905	(83)
Total gains	597.9995	645.6669	707.1948	788.0051	856.2887	853.2517	809.1933	733.6477	655.0797	588.8649	565.2534	575.0697	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	111.1398	111.6577	112.1805	114.8696	115.4229	118.2717	118.2717	118.8584	117.1155	115.4229	114.3215	113.2409	
alpha	8.4093	8.4438	8.4787	8.6580	8.6949	8.8848	8.8848	8.9239	8.8077	8.6949	8.6214	8.5494	
util living area	0.8907	0.8306	0.7092	0.5274	0.3719	0.2507	0.1817	0.2085	0.3555	0.6018	0.8105	0.9039	(86)
MIT	20.8722	20.9298	20.9803	20.9984	20.9999	21.0000	21.0000	21.0000	21.0000	20.9963	20.9530	20.8608	(87)
Th 2	20.5243	20.5264	20.5285	20.5391	20.5412	20.5518	20.5518	20.5539	20.5476	20.5412	20.5370	20.5327	(88)
util rest of house	0.8771	0.8135	0.6886	0.5076	0.3536	0.2332	0.1632	0.1883	0.3322	0.5761	0.7902	0.8914	(89)
MIT 2	20.3839	20.4516	20.5087	20.5376	20.5412	20.5518	20.5518	20.5539	20.5476	20.5379	20.4887	20.3786	(90)
Living area fraction										fLA = Living area / (4) =		0.4021	(91)
MIT	20.5802	20.6438	20.6983	20.7228	20.7256	20.7320	20.7320	20.7333	20.7295	20.7222	20.6754	20.5725	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5802	20.6438	20.6983	20.7228	20.7256	20.7320	20.7320	20.7333	20.7295	20.7222	20.6754	20.5725	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8788	0.8178	0.6961	0.5155	0.3610	0.2402	0.1707	0.1964	0.3416	0.5863	0.7964	0.8925	(94)
Useful gains	525.5185	528.0545	492.2508	406.2317	309.0939	204.9590	138.1105	144.1228	223.7621	345.2470	450.1599	513.2582	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	579.0763	557.4003	500.3404	406.8764	309.1219	204.9594	138.1105	144.1229	223.7735	346.6793	469.4288	571.5536	(97)
Space heating kWh	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(98a)
Space heating requirement - total per year (kWh/year)												124.3821	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												124.3821	
Space heating per m2										(98c) / (4) =		1.7352	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.2264	11.9464	13.2264	12.7997	13.2264	12.7997	13.2264	13.2264	12.7997	13.2264	12.7997	13.2264	(231)
Lighting	20.4758	16.4264	14.7902	10.8359	8.3700	6.8383	7.6354	9.9247	12.8912	16.9140	19.1043	21.0448	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-17.0008	-26.9528	-43.7049	-55.0326	-64.6365	-62.1981	-61.2076	-55.2744	-45.1885	-33.0016	-19.5873	-14.3353	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.4971	-8.1867	-18.2196	-30.3147	-42.3617	-43.5158	-42.8995	-34.7392	-23.7344	-12.5240	-4.9201	-2.6818	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	124.3821	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2554.7746	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	155.7302	(230a)
Total electricity for the above, kWh/year	155.7302	(231)
Electricity for lighting (calculated in Appendix L)	165.2510	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-765.7149	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2234.4231	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	124.3821	16.4900	20.5106	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	16.4900	421.2823	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	155.7302	16.4900	25.6799	(249)
Energy for lighting	165.2510	16.4900	27.2499	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.1204	16.4900	-82.1401	
PV Unit electricity exported	-267.5945	5.5900	-14.9585	
Total			-97.0986	(252)
Total energy cost			397.6242	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2268	(257)
SAP value		80.1133	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	124.3821	0.1604	19.9497	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2554.7746	0.1413	360.9927	(264)
Space and water heating			380.9424	(265)
Pumps, fans and electric keep-hot	155.7302	0.1387	21.6017	(267)
Energy for lighting	165.2510	0.1443	23.8508	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.1204	0.1323	-65.9162	
PV Unit electricity exported	-267.5945	0.1234	-33.0212	
Total			-98.9374	(269)
Total CO2, kg/year			327.4575	(272)
CO2 emissions per m2			4.5700	(273)
EI value			96.2393	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	71.6800	(1b)	x 2.4000	(2b) =	172.0320	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 71.6800						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		172.0320	(5)

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2. Ventilation rate

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m3 per hour

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	28.6200	11.8100	16.8100	0.1400	2.3534	14.0000	235.3400	(29a)
Total net area of external elements Aum(A, m2)			28.6200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.9475			(33)
Party Wall 1			41.7100	0.0000	0.0000	20.0000	834.2000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			71.6800			80.0000	5734.4000	(32d)
Party Ceiling 1			71.6800			80.0000	5734.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14231.4100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		198.5409 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	10.6000	0.0700	0.7420
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.9000	0.0000	0.0000
E16 Corner (normal)	2.7000	0.0900	0.2430

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		2.2595 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	19.2070 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.5273	16.5273	16.1974	15.2074	15.0424	14.3825	14.0525	14.0525	14.7124	15.5374	15.8674	15.7024	(38)
Heat transfer coeff	35.7343	35.7343	35.4044	34.4144	34.2494	33.5895	33.2595	33.2595	33.9195	34.7444	35.0744	34.9094	(39)
Average = Sum(39)m / 12 =												34.5244	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4985	0.4985	0.4939	0.4801	0.4778	0.4686	0.4640	0.4640	0.4732	0.4847	0.4893	0.4870	(40)
HLP (average)												0.4816	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.2862 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
86.0089	84.7163	82.8328	79.2291	76.5696	73.6038	71.9181	73.7873	75.8363	79.0207	82.7018	85.6793	(42a)

Hot water usage for baths

27.0226	26.6213	26.0561	25.0141	24.2338	23.3686	22.9013	23.4625	24.0735	24.9993	26.0628	26.9312	(42b)

Hot water usage for other uses

38.0431	36.6597	35.2763	33.8929	32.5095	31.1262	31.1262	32.5095	33.8929	35.2763	36.6597	38.0431	(42c)

Average daily hot water use (litres/day)	138.9361 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.0745	147.9973	144.1652	138.1361	133.3130	128.0986	125.9455	129.7594	133.8028	139.2963	145.4243	150.6536	(44)
Energy conte	239.2651	210.7461	221.5766	189.1014	179.4649	157.5122	152.3202	160.6692	164.9922	189.0238	207.1836	235.8872	(45)
Energy content (annual)											Total = Sum(45)m =	2307.7426	

Distribution loss (46)m = 0.15 x (45)m

35.8898	31.6119	33.2365	28.3652	26.9197	23.6268	22.8480	24.1004	24.7488	28.3536	31.0775	35.3831	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680 (64)
										Total per year (kWh/year) = Sum(64)m =		2554.7746 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000 (64a)
Heat gains from water heating, kWh/month												
	96.3403	85.2334	90.4589	79.1194	76.4567	68.6160	67.4311	70.2071	71.1031	79.6351	85.1318	95.2171 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.3930	20.7775	16.8974	12.7924	9.5625	8.0730	8.7232	11.3387	15.2188	19.3238	22.5537	24.0432	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	300.2774	303.3934	295.5413	278.8252	257.7241	237.8920	224.6430	221.5270	229.3791	246.0952	267.1963	287.0284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	(71)
Water heating gains (Table 5)													
	129.4896	126.8354	121.5845	109.8881	102.7644	95.3000	90.6332	94.3644	98.7543	107.0364	118.2386	127.9800	(72)
Total internal gains													
	549.8877	547.7339	530.7508	498.2333	466.7786	437.9927	420.7271	423.9579	440.0799	469.1831	504.7163	535.7792	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(75)

Solar gains	42.7730	92.6022	174.0550	301.5827	403.2921	419.0362	396.3745	305.8819	210.3213	112.3593	55.2465	35.7661	(83)
Total gains	592.6608	640.3361	704.8058	799.8160	870.0707	857.0289	817.1015	729.8397	650.4012	581.5423	559.9628	571.5453	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	110.6266	110.6266	111.6577	114.8696	115.4229	117.6907	118.8584	118.8584	116.5458	113.7786	112.7082	113.2409	
alpha	8.3751	8.3751	8.4438	8.6580	8.6949	8.8460	8.9239	8.9239	8.7697	8.5852	8.5139	8.5494	
util living area													
	0.9065	0.8593	0.7516	0.5619	0.4054	0.3057	0.2483	0.2825	0.4275	0.6674	0.8432	0.9182	(86)
MIT	20.8464	20.9031	20.9677	20.9971	20.9998	21.0000	21.0000	21.0000	20.9998	20.9906	20.9314	20.8348	(87)
Th 2	20.5222	20.5222	20.5264	20.5391	20.5412	20.5497	20.5539	20.5539	20.5455	20.5349	20.5306	20.5327	(88)
util rest of house													
	0.8943	0.8439	0.7321	0.5426	0.3873	0.2881	0.2301	0.2622	0.4039	0.6418	0.8246	0.9073	(89)
MIT 2	20.3514	20.4171	20.4931	20.5364	20.5411	20.5497	20.5539	20.5539	20.5453	20.5262	20.4588	20.3477	(90)
Living area fraction										fLA = Living area / (4) =		0.4021	(91)
MIT	20.5504	20.6125	20.6839	20.7216	20.7255	20.7307	20.7333	20.7333	20.7280	20.7130	20.6488	20.5436	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5504	20.6125	20.6839	20.7216	20.7255	20.7307	20.7333	20.7333	20.7280	20.7130	20.6488	20.5436	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8951	0.8469	0.7387	0.5502	0.3946	0.2951	0.2374	0.2704	0.4134	0.6517	0.8294	0.9075	(94)
Useful gains	530.4783	542.2746	520.6325	440.0970	343.3043	252.9499	194.0117	197.3368	268.8466	378.9737	464.4567	518.6920	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	594.9914	582.9178	534.0374	441.2484	343.3684	252.9535	194.0121	197.3380	268.9149	382.6385	492.7526	587.9989	(97)
Space heating kWh													
	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643	(98a)
Space heating requirement - total per year (kWh/year)												160.8238	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												160.8238	
Space heating per m2											(98c) / (4) =	2.2436	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement												

	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643 (98)
Space heating efficiency (main heating system 1)												
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)												
	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	13.2264	11.9464	13.2264	12.7997	13.2264	12.7997	13.2264	13.2264	12.7997	13.2264	12.7997	13.2264 (231)
Lighting	20.4758	16.4264	14.7902	10.8359	8.3700	6.8383	7.6354	9.9247	12.8912	16.9140	19.1043	21.0448 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-15.4126	-25.9729	-43.7522	-57.3553	-66.8995	-63.0965	-62.6159	-55.2911	-44.8919	-31.6377	-18.2309	-13.2576 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.9589	-7.6180	-18.1511	-32.6607	-45.1941	-44.7217	-44.8029	-34.7587	-23.4550	-11.6200	-4.3363	-2.3448 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	160.8238 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2554.7746 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	155.7302 (230a)
Total electricity for the above, kWh/year	155.7302 (231)
Electricity for lighting (calculated in Appendix L)	165.2510 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-771.0360 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2265.5437 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	160.8238	25.1600	40.4633	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	25.1600	642.7813	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	155.7302	25.1600	39.1817	(249)
Energy for lighting	165.2510	25.1600	41.5772	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.4140	25.1600	-125.4010	
PV Unit electricity exported	-272.6220	5.8100	-15.8393	
Total			-141.2403	(252)
Total energy cost			622.7632	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	160.8238	0.1598	25.6965	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2554.7746	0.1413	360.9927	(264)
Space and water heating			386.6891	(265)
Pumps, fans and electric keep-hot	155.7302	0.1387	21.6017	(267)
Energy for lighting	165.2510	0.1443	23.8508	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.4140	0.1320	-65.8025	
PV Unit electricity exported	-272.6220	0.1229	-33.5042	
Total			-99.3067	(269)
Total CO2, kg/year			332.8350	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	

Space heating - main system 1	160.8238	1.5914	255.9292	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	1.5225	3889.6458	(278)
Space and water heating			4145.5750	(279)
Pumps, fans and electric keep-hot	155.7302	1.5128	235.5887	(281)
Energy for lighting	165.2510	1.5338	253.4676	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.4140	1.4878	-741.5395	
PV Unit electricity exported	-272.6220	0.4510	-122.9601	
Total			-864.4997	(283)
Total Primary energy kWh/year			3770.1316	(286)

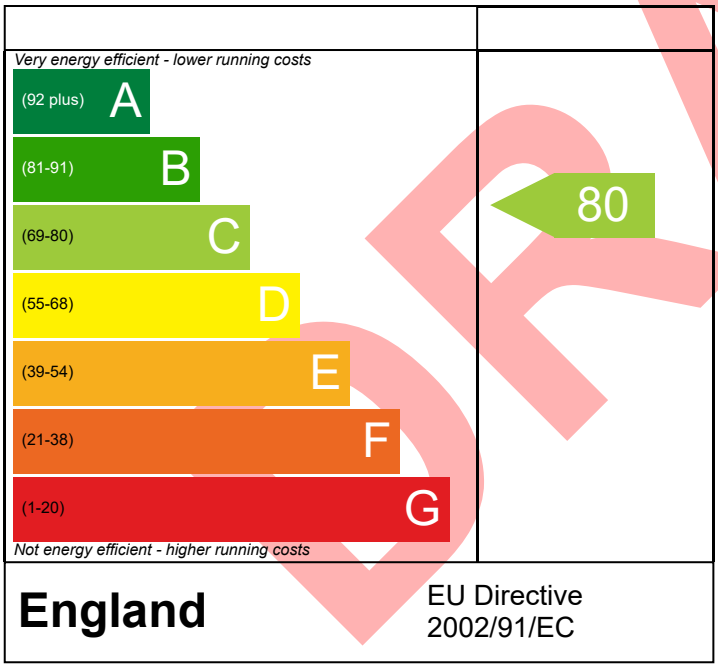
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	71.68 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

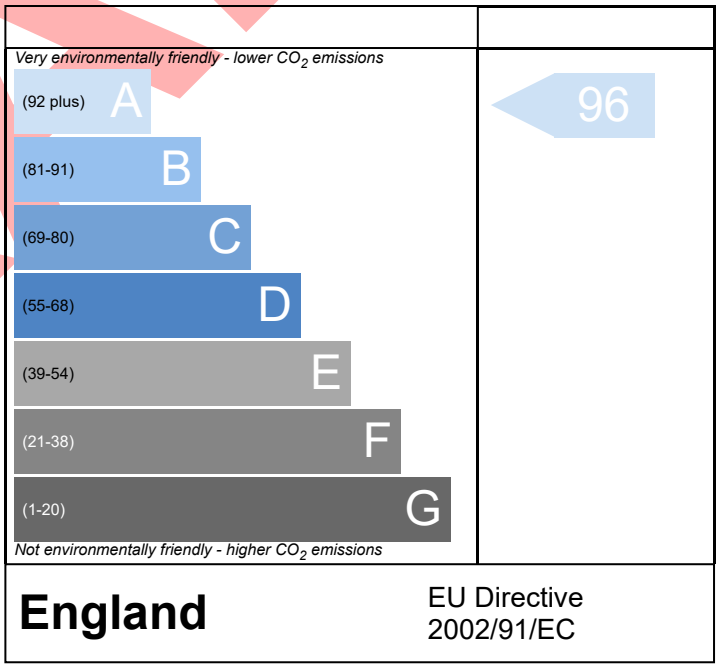
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:17

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	51 m^2
Site Reference	Unit 395 L03_Copy	Plot Reference	Unit 395 L03_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.04 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	5.4 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*60.15 kWh$_{PE}$/m^2*	
Dwelling primary energy	60.84 kWh$_{PE}$/m^2	FAIL
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*11.7 kWh/m^2*	
Dwelling fabric energy efficiency	10.6 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	10.01	0.14 **(!)**
Party wall: Party Wall (1)	46.44	0 **(!)**
Party wall: Party Wall (2)	16.06	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	6.05	South West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.66 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 395 L03_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 395 L03_Copy	**Prop Type Ref**	Unit 395 L03
Property			

SAP Rating	80 C	**DER**	5.40	**TER**	11.04
Environmental	96 A	**% DER < TER**			51.09
CO_2 Emissions (t/year)	0.28	**DFEE**	10.56	**TFEE**	11.66
Compliance Check	See BREL	**% DFEE < TFEE**			9.46
% DPER < TPER	-1.15	**DPER**	60.84	**TPER**	60.15

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.1700	(1b)	x 2.4000	(2b) =	122.8080	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.1700					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		122.8080	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												72.0000	(23c)
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.0500	1.2357	7.4762			(27)
External Wall 1	16.0600	6.0500	10.0100	0.1400	1.4014	14.0000	140.1400	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		8.8776			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			16.0600	0.0000	0.0000	20.0000	321.2000	(32)
Party Floor 1			51.1700			80.0000	4093.6000	(32d)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			79.3800			9.0000	714.4200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10291.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		201.1288 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.6000	0.0500	0.1300

E4 Jamb	9.2800	0.0500	0.4640	
E7 Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.3345 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 10.2121 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.6805	11.5628	11.4450	10.8561	10.7383	10.1494	10.1494	10.0316	10.3850	10.7383	10.9739	11.2094	(38)
Heat transfer coeff	21.8927	21.7749	21.6571	21.0682	20.9504	20.3615	20.3615	20.2437	20.5971	20.9504	21.1860	21.4216	(39)
Average = Sum(39)m / 12 =												21.0388	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4278	0.4255	0.4232	0.4117	0.4094	0.3979	0.3979	0.3956	0.4025	0.4094	0.4140	0.4186	(40)
HLP (average)												0.4112	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7246 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.0608	71.9628	70.3629	67.3017	65.0426	62.5233	61.0913	62.6791	64.4197	67.1247	70.2516	72.7809	(42a)
Hot water usage for baths	22.9731	22.6319	22.1514	21.2656	20.6022	19.8667	19.4694	19.9465	20.4660	21.2530	22.1571	22.8954	(42b)
Hot water usage for other uses	32.2915	31.1172	29.9430	28.7688	27.5945	26.4203	26.4203	27.5945	28.7688	29.9430	31.1172	32.2915	(42c)
Average daily hot water use (litres/day)												118.0151	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.3253	125.7119	122.4573	117.3360	113.2393	108.8102	106.9810	110.2201	113.6544	118.3207	123.5260	127.9677	(44)
Energy conte	203.2359	179.0121	188.2123	160.6271	152.4419	133.7949	129.3842	136.4755	140.1472	160.5600	175.9854	200.3665	(45)
Energy content (annual)										Total = Sum(45)m =		1960.2433	
Distribution loss (46)m = 0.15 x (45)m	30.4854	26.8518	28.2318	24.0941	22.8663	20.0692	19.4076	20.4713	21.0221	24.0840	26.3978	30.0550	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
										Total per year (kWh/year) = Sum(64)m =		2207.2753	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	84.3606	74.6819	79.3652	69.6517	67.4716	60.7300	59.8049	62.1628	62.8422	70.1708	74.7583	83.4065	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.5665	16.4906	13.4111	10.1530	7.5895	6.4074	6.9234	8.9993	12.0789	15.3369	17.9004	19.0825	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	224.2868	226.6142	220.7492	208.2634	192.5023	177.6891	167.7930	165.4656	171.3306	183.8164	199.5774	214.3906	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	(71)
Water heating gains (Table 5)	113.3879	111.1337	106.6737	96.7385	90.6876	84.3472	80.3829	83.5521	87.2808	94.3157	103.8310	112.1055	(72)
Total internal gains	437.8050	435.8023	422.3978	396.7187	372.3432	350.0075	336.6631	339.5808	352.2540	375.0327	402.8727	427.1425	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	6.0500	36.7938	0.6300	0.8270	0.7700	80.3729	(79)

Solar gains	80.3729	136.9048	187.3191	232.0975	259.9685	258.0886	248.8249	228.0319	202.8270	151.3090	96.2682	68.7825	(83)
Total gains	518.1779	572.7071	609.7169	628.8162	632.3117	608.0961	585.4880	567.6127	555.0810	526.3417	499.1409	495.9250	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	130.5835	131.2898	132.0039	135.6936	136.4565	140.4031	140.4031	141.2200	138.7974	136.4565	134.9393	133.4554	
alpha	9.7056	9.7527	9.8003	10.0462	10.0971	10.3602	10.3602	10.4147	10.2532	10.0971	9.9960	9.8970	
util living area													
	0.6984	0.6101	0.5147	0.4054	0.3081	0.2143	0.1530	0.1641	0.2560	0.4139	0.5887	0.7171	(86)
MIT	20.9890	20.9967	20.9993	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9999	20.9982	20.9875	(87)
Th 2	20.5874	20.5896	20.5917	20.6024	20.6045	20.6153	20.6153	20.6174	20.6110	20.6045	20.6003	20.5960	(88)
util rest of house													
	0.6823	0.5950	0.5003	0.3921	0.2950	0.2014	0.1396	0.1504	0.2416	0.3982	0.5721	0.7013	(89)
MIT 2	20.5761	20.5862	20.5910	20.6024	20.6045	20.6153	20.6153	20.6174	20.6110	20.6045	20.5985	20.5829	(90)
Living area fraction										fLA = Living area / (4) =		0.5576	(91)
MIT	20.8063	20.8150	20.8187	20.8240	20.8250	20.8298	20.8298	20.8307	20.8279	20.8250	20.8213	20.8085	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.8063	20.8150	20.8187	20.8240	20.8250	20.8298	20.8298	20.8307	20.8279	20.8250	20.8213	20.8085	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6909	0.6033	0.5083	0.3995	0.3023	0.2086	0.1471	0.1580	0.2496	0.4070	0.5813	0.7096	(94)
Useful gains	357.9877	345.5238	309.8992	251.2030	191.1725	126.8478	86.1248	89.6946	138.5746	214.2033	290.1524	351.9190	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	361.3675	346.5482	310.1013	251.2180	191.1733	126.8478	86.1248	89.6946	138.5747	214.2178	290.7000	355.7795	(97)
Space heating kWh													
	2.5146	0.6884	0.1504	0.0108	0.0006	0.0000	0.0000	0.0000	0.0000	0.0108	0.3943	2.8722	(98a)
Space heating requirement - total per year (kWh/year)												6.6421	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	2.5146	0.6884	0.1504	0.0108	0.0006	0.0000	0.0000	0.0000	0.0000	0.0108	0.3943	2.8722	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6.6421	
Space heating per m2											(98c) / (4) =	0.1298	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	2.5146	0.6884	0.1504	0.0108	0.0006	0.0000	0.0000	0.0000	0.0000	0.0108	0.3943	2.8722	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	2.5146	0.6884	0.1504	0.0108	0.0006	0.0000	0.0000	0.0000	0.0000	0.0108	0.3943	2.8722	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9074	8.0454	8.9074	8.6201	8.9074	8.6201	8.9074	8.9074	8.6201	8.9074	8.6201	8.9074	(231)
Lighting	16.2512	13.0373	11.7386	8.6002	6.6431	5.4274	6.0600	7.8770	10.2315	13.4243	15.1627	16.7028	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.1380	-19.3589	-31.6538	-40.1502	-47.3719	-45.6699	-44.9508	-40.4933	-32.9629	-23.9064	-14.0617	-10.2247	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4089	-5.5789	-12.2926	-20.4189	-28.5624	-29.3529	-28.9317	-23.3873	-15.9501	-8.4020	-3.3306	-1.8520	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	6.6421	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2207.2753	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	104.8780	(230a)
Total electricity for the above, kWh/year	104.8780	(231)
Electricity for lighting (calculated in Appendix L)	131.1561	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-543.4106	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1906.5410	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	6.6421	16.4900	1.0953	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	16.4900	363.9797	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	104.8780	16.4900	17.2944	(249)
Energy for lighting	131.1561	16.4900	21.6276	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-362.9424	16.4900	-59.8492	
PV Unit electricity exported	-180.4682	5.5900	-10.0882	
Total			-69.9374	(252)
Total energy cost			334.0596	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2505	(257)
SAP value	79.7292	
SAP rating (Section 12)	80	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6.6421	0.1617	1.0738	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2207.2753	0.1413	311.7942	(264)
Space and water heating			312.8681	(265)
Pumps, fans and electric keep-hot	104.8780	0.1387	14.5479	(267)
Energy for lighting	131.1561	0.1443	18.9299	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-362.9424	0.1322	-47.9814	
PV Unit electricity exported	-180.4682	0.1235	-22.2818	
Total			-70.2632	(269)
Total CO2, kg/year			276.0827	(272)
CO2 emissions per m2			5.4000	(273)
EI value			96.1532	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		51.1700 (1b)	x	2.4000 (2b)	=	122.8080	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.1700						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	122.8080	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.0500	1.2357	7.4762			(27)
External Wall 1	16.0600	6.0500	10.0100	0.1400	1.4014	14.0000	140.1400	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		8.8776			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			16.0600	0.0000	0.0000	20.0000	321.2000	(32)
Party Floor 1			51.1700			80.0000	4093.6000	(32d)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			79.3800			9.0000	714.4200	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 10291.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 201.1288 (35)
List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	2.6000	0.0500	0.1300
E4	Jamb	9.2800	0.0500	0.4640
E7	Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165
E18	Party wall between dwellings	5.4000	0.0600	0.3240
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.3345 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 10.2121 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.7983	11.7983	11.5628	10.8561	10.7383	10.2672	10.0316	10.0316	10.5027	11.0916	11.3272	11.2094	(38)
Heat transfer coeff	22.0105	22.0105	21.7749	21.0682	20.9504	20.4793	20.2437	20.2437	20.7149	21.3038	21.5393	21.4216	(39)

Average = Sum(39)m / 12 = 21.1467

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4301	0.4301	0.4255	0.4117	0.4094	0.4002	0.3956	0.3956	0.4048	0.4163	0.4209	0.4186	(40)
HLP (average)												0.4133	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7246 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.0608	71.9628	70.3629	67.3017	65.0426	62.5233	61.0913	62.6791	64.4197	67.1247	70.2516	72.7809	(42a)
Hot water usage for baths	22.9731	22.6319	22.1514	21.2656	20.6022	19.8667	19.4694	19.9465	20.4660	21.2530	22.1571	22.8954	(42b)
Hot water usage for other uses	32.2915	31.1172	29.9430	28.7688	27.5945	26.4203	26.4203	27.5945	28.7688	29.9430	31.1172	32.2915	(42c)

Average daily hot water use (litres/day) 118.0151 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.3253	125.7119	122.4573	117.3360	113.2393	108.8102	106.9810	110.2201	113.6544	118.3207	123.5260	127.9677	(44)
Energy conte	203.2359	179.0121	188.2123	160.6271	152.4419	133.7949	129.3842	136.4755	140.1472	160.5600	175.9854	200.3665	(45)
Energy content (annual)										Total = Sum(45)m =		1960.2433	
Distribution loss (46)m = 0.15 x (45)m	30.4854	26.8518	28.2318	24.0941	22.8663	20.0692	19.4076	20.4713	21.0221	24.0840	26.3978	30.0550	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
										Total per year (kWh/year) = Sum(64)m =		2207.2753	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	84.3606	74.6819	79.3652	69.6517	67.4716	60.7300	59.8049	62.1628	62.8422	70.1708	74.7583	83.4065	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.5665	16.4906	13.4111	10.1530	7.5895	6.4074	6.9234	8.9993	12.0789	15.3369	17.9004	19.0825	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	224.2868	226.6142	220.7492	208.2634	192.5023	177.6891	167.7930	165.4656	171.3306	183.8164	199.5774	214.3906	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	(71)
Water heating gains (Table 5)													
	113.3879	111.1337	106.6737	96.7385	90.6876	84.3472	80.3829	83.5521	87.2808	94.3157	103.8310	112.1055	(72)
Total internal gains													
	437.8050	435.8023	422.3978	396.7187	372.3432	350.0075	336.6631	339.5808	352.2540	375.0327	402.8727	427.1425	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	6.0500	33.4622	0.6300	0.8270	0.7700	73.0953	(79)

Solar gains	73.0953	132.8884	190.0221	247.6641	274.5958	264.9514	258.6131	230.4683	203.9112	145.9899	89.9762	63.9718	(83)
Total gains	510.9003	568.6907	612.4199	644.3828	646.9390	614.9590	595.2762	570.0491	556.1652	521.0226	492.8488	491.1143	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	129.8847	129.8847	131.2898	135.6936	136.4565	139.5957	141.2200	141.2200	138.0082	134.1933	132.7257	133.4554	
alpha	9.6590	9.6590	9.7527	10.0462	10.0971	10.3064	10.4147	10.4147	10.2005	9.9462	9.8484	9.8970	
util living area													
	0.7262	0.6429	0.5469	0.4283	0.3336	0.2598	0.2074	0.2202	0.3054	0.4619	0.6269	0.7426	(86)
MIT	20.9842	20.9943	20.9987	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9998	20.9964	20.9827	(87)
Th 2	20.5853	20.5853	20.5896	20.6024	20.6045	20.6131	20.6174	20.6174	20.6088	20.5981	20.5938	20.5960	(88)
util rest of house													
	0.7102	0.6276	0.5324	0.4153	0.3207	0.2469	0.1944	0.2066	0.2908	0.4455	0.6097	0.7272	(89)
MIT 2	20.5688	20.5795	20.5883	20.6023	20.6045	20.6131	20.6174	20.6174	20.6088	20.5980	20.5903	20.5778	(90)
Living area fraction										fLA = Living area / (4) =		0.5576	(91)
MIT	20.8004	20.8108	20.8171	20.8240	20.8250	20.8288	20.8307	20.8307	20.8269	20.8220	20.8168	20.8036	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.8004	20.8108	20.8171	20.8240	20.8250	20.8288	20.8307	20.8307	20.8269	20.8220	20.8168	20.8036	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7185	0.6360	0.5404	0.4225	0.3279	0.2541	0.2017	0.2142	0.2990	0.4547	0.6191	0.7352	(94)
Useful gains	367.1006	361.6592	330.9707	272.2579	212.1218	156.2330	120.0602	122.0846	166.2762	236.8899	305.1447	361.0442	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	371.9854	363.4094	331.3518	272.2854	212.1236	156.2331	120.0602	122.0846	166.2767	236.9409	306.2195	366.3847	(97)
Space heating kWh													
	3.6342	1.1761	0.2835	0.0197	0.0014	0.0000	0.0000	0.0000	0.0000	0.0379	0.7738	3.9733	(98a)
Space heating requirement - total per year (kWh/year)												9.9001	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	3.6342	1.1761	0.2835	0.0197	0.0014	0.0000	0.0000	0.0000	0.0000	0.0379	0.7738	3.9733	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9.9001	
Space heating per m2										(98c) / (4) =		0.1935	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	3.6342	1.1761	0.2835	0.0197	0.0014	0.0000	0.0000	0.0000	0.0000	0.0379	0.7738	3.9733	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	3.6342	1.1761	0.2835	0.0197	0.0014	0.0000	0.0000	0.0000	0.0000	0.0379	0.7738	3.9733	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9074	8.0454	8.9074	8.6201	8.9074	8.6201	8.9074	8.9074	8.6201	8.9074	8.6201	8.9074	(231)

Lighting	16.2512	13.0373	11.7386	8.6002	6.6431	5.4274	6.0600	7.8770	10.2315	13.4243	15.1627	16.7028	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.9890	-18.6157	-31.6465	-41.8691	-49.0676	-46.3455	-46.0104	-40.5058	-32.7427	-22.8928	-13.0639	-9.4446	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.0488	-5.2230	-12.2849	-22.0132	-30.4827	-30.1706	-30.2222	-23.4005	-15.7615	-7.8062	-2.9515	-1.6281	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	9.9001	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2207.2753	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	104.8780	(230a)
Total electricity for the above, kWh/year	104.8780	(231)
Electricity for lighting (calculated in Appendix L)	131.1561	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-547.1869	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1906.0227	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	9.9001	25.1600	2.4909	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	25.1600	555.3505	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	104.8780	25.1600	26.3873	(249)
Energy for lighting	131.1561	25.1600	32.9989	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1936	25.1600	-91.3795	
PV Unit electricity exported	-183.9933	5.8100	-10.6900	
Total			-102.0695	(252)
Total energy cost			515.1580	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	9.9001	0.1613	1.5966	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2207.2753	0.1413	311.7942	(264)
Space and water heating			313.3909	(265)
Pumps, fans and electric keep-hot	104.8780	0.1387	14.5479	(267)
Energy for lighting	131.1561	0.1443	18.9299	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1936	0.1319	-47.9013	
PV Unit electricity exported	-183.9933	0.1230	-22.6294	
Total			-70.5307	(269)
Total CO2, kg/year			276.3379	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	9.9001	1.5968	15.8083	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	1.5223	3360.2168	(278)
Space and water heating			3376.0251	(279)
Pumps, fans and electric keep-hot	104.8780	1.5128	158.6595	(281)
Energy for lighting	131.1561	1.5338	201.1716	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1936	1.4873	-540.1750	
PV Unit electricity exported	-183.9933	0.4514	-83.0493	
Total			-623.2243	(283)
Total Primary energy kWh/year			3112.6319	(286)

SAP 10 EPC IMPROVEMENTS

Unit 395 L03_Copy

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 80
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£617	£617	£0
Space heating	£29	£29	£0
Water heating	£555	£555	£0
Lighting	£33	£33	£0
Generated (PV)	-£102	-£102	£0
Total cost of fuels	£515	£515	£0
Total cost of uses	£515	£515	£0
Delivered energy	37 kWh/m²	37 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	61 kWh/m²	61 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.1700 (1b)	x	2.4000 (2b)	=	122.8080	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.1700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	122.8080	(5)

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2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor (20) = 1 - [0.075 x (19)] =		0.7750 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) =		0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.0500	1.2357	7.4762			(27)
External Wall 1	16.0600	6.0500	10.0100	0.1400	1.4014	14.0000	140.1400	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		8.8776			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			16.0600	0.0000	0.0000	20.0000	321.2000	(32)
Party Floor 1			51.1700			80.0000	4093.6000	(32d)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			79.3800			9.0000	714.4200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10291.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		201.1288 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.6000	0.0500	0.1300
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.3345 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	10.2121 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.6805	11.5628	11.4450	10.8561	10.7383	10.1494	10.1494	10.0316	10.3850	10.7383	10.9739	11.2094	(38)
Heat transfer coeff	21.8927	21.7749	21.6571	21.0682	20.9504	20.3615	20.3615	20.2437	20.5971	20.9504	21.1860	21.4216	(39)
Average = Sum(39)m / 12 =												21.0388	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4278	0.4255	0.4232	0.4117	0.4094	0.3979	0.3979	0.3956	0.4025	0.4094	0.4140	0.4186	(40)
HLP (average)												0.4112	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.7246 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.0608	71.9628	70.3629	67.3017	65.0426	62.5233	61.0913	62.6791	64.4197	67.1247	70.2516	72.7809	(42a)

Hot water usage for baths

22.9731	22.6319	22.1514	21.2656	20.6022	19.8667	19.4694	19.9465	20.4660	21.2530	22.1571	22.8954	(42b)

Hot water usage for other uses

32.2915	31.1172	29.9430	28.7688	27.5945	26.4203	26.4203	27.5945	28.7688	29.9430	31.1172	32.2915	(42c)

Average daily hot water use (litres/day)		118.0151 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.3253	125.7119	122.4573	117.3360	113.2393	108.8102	106.9810	110.2201	113.6544	118.3207	123.5260	127.9677	(44)
Energy conte	203.2359	179.0121	188.2123	160.6271	152.4419	133.7949	129.3842	136.4755	140.1472	160.5600	175.9854	200.3665	(45)
Energy content (annual)										Total = Sum(45)m =		1960.2433	

Distribution loss (46)m = 0.15 x (45)m

30.4854	26.8518	28.2318	24.0941	22.8663	20.0692	19.4076	20.4713	21.0221	24.0840	26.3978	30.0550	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
									Total per year (kWh/year) = Sum(64)m =		2207.2753	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

84.3606	74.6819	79.3652	69.6517	67.4716	60.7300	59.8049	62.1628	62.8422	70.1708	74.7583	83.4065	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.5665	16.4906	13.4111	10.1530	7.5895	6.4074	6.9234	8.9993	12.0789	15.3369	17.9004	19.0825	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	224.2868	226.6142	220.7492	208.2634	192.5023	177.6891	167.7930	165.4656	171.3306	183.8164	199.5774	214.3906	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	(71)
Water heating gains (Table 5)	113.3879	111.1337	106.6737	96.7385	90.6876	84.3472	80.3829	83.5521	87.2808	94.3157	103.8310	112.1055	(72)
Total internal gains	437.8050	435.8023	422.3978	396.7187	372.3432	350.0075	336.6631	339.5808	352.2540	375.0327	402.8727	427.1425	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	6.0500	36.7938	0.6300	0.8270	0.7700	80.3729	(79)

Solar gains	80.3729	136.9048	187.3191	232.0975	259.9685	258.0886	248.8249	228.0319	202.8270	151.3090	96.2682	68.7825	(83)
Total gains	518.1779	572.7071	609.7169	628.8162	632.3117	608.0961	585.4880	567.6127	555.0810	526.3417	499.1409	495.9250	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	130.5835	131.2898	132.0039	135.6936	136.4565	140.4031	140.4031	141.2200	138.7974	136.4565	134.9393	133.4554	
alpha	9.7056	9.7527	9.8003	10.0462	10.0971	10.3602	10.3602	10.4147	10.2532	10.0971	9.9960	9.8970	
util living area	0.6984	0.6101	0.5147	0.4054	0.3081	0.2143	0.1530	0.1641	0.2560	0.4139	0.5887	0.7171	(86)
MIT	20.9890	20.9967	20.9993	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9999	20.9982	20.9875	(87)
Th 2	20.5874	20.5896	20.5917	20.6024	20.6045	20.6153	20.6153	20.6174	20.6110	20.6045	20.6003	20.5960	(88)
util rest of house	0.6823	0.5950	0.5003	0.3921	0.2950	0.2014	0.1396	0.1504	0.2416	0.3982	0.5721	0.7013	(89)
MIT 2	20.5761	20.5862	20.5910	20.6024	20.6045	20.6153	20.6153	20.6174	20.6110	20.6045	20.5985	20.5829	(90)
Living area fraction									fLA = Living area / (4) =			0.5576	(91)
MIT	20.8063	20.8150	20.8187	20.8240	20.8250	20.8298	20.8298	20.8307	20.8279	20.8250	20.8213	20.8085	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.8063	20.8150	20.8187	20.8240	20.8250	20.8298	20.8298	20.8307	20.8279	20.8250	20.8213	20.8085	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6909	0.6033	0.5083	0.3995	0.3023	0.2086	0.1471	0.1580	0.2496	0.4070	0.5813	0.7096	(94)
Useful gains	357.9877	345.5238	309.8992	251.2030	191.1725	126.8478	86.1248	89.6946	138.5746	214.2033	290.1524	351.9190	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	361.3675	346.5482	310.1013	251.2180	191.1733	126.8478	86.1248	89.6946	138.5747	214.2178	290.7000	355.7795	(97)
Space heating kWh	2.5146	0.6884	0.1504	0.0108	0.0006	0.0000	0.0000	0.0000	0.0000	0.0108	0.3943	2.8722	(98a)
Space heating requirement - total per year (kWh/year)												6.6421	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	2.5146	0.6884	0.1504	0.0108	0.0006	0.0000	0.0000	0.0000	0.0000	0.0108	0.3943	2.8722	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6.6421	
Space heating per m2											(98c) / (4) =	0.1298	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	2.5146	0.6884	0.1504	0.0108	0.0006	0.0000	0.0000	0.0000	0.0000	0.0108	0.3943	2.8722	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	2.5146	0.6884	0.1504	0.0108	0.0006	0.0000	0.0000	0.0000	0.0000	0.0108	0.3943	2.8722	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9074	8.0454	8.9074	8.6201	8.9074	8.6201	8.9074	8.9074	8.6201	8.9074	8.6201	8.9074	(231)
Lighting	16.2512	13.0373	11.7386	8.6002	6.6431	5.4274	6.0600	7.8770	10.2315	13.4243	15.1627	16.7028	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.1380	-19.3589	-31.6538	-40.1502	-47.3719	-45.6699	-44.9508	-40.4933	-32.9629	-23.9064	-14.0617	-10.2247	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4089	-5.5789	-12.2926	-20.4189	-28.5624	-29.3529	-28.9317	-23.3873	-15.9501	-8.4020	-3.3306	-1.8520	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												6.6421	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2207.2753	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	104.8780	(230a)
Total electricity for the above, kWh/year	104.8780	(231)
Electricity for lighting (calculated in Appendix L)	131.1561	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-543.4106	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1906.5410	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	6.6421	16.4900	1.0953	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	16.4900	363.9797	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	104.8780	16.4900	17.2944	(249)
Energy for lighting	131.1561	16.4900	21.6276	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-362.9424	16.4900	-59.8492	
PV Unit electricity exported	-180.4682	5.5900	-10.0882	
Total			-69.9374	(252)
Total energy cost			334.0596	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2505	(257)
SAP value		79.7292	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6.6421	0.1617	1.0738	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2207.2753	0.1413	311.7942	(264)
Space and water heating			312.8681	(265)
Pumps, fans and electric keep-hot	104.8780	0.1387	14.5479	(267)
Energy for lighting	131.1561	0.1443	18.9299	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-362.9424	0.1322	-47.9814	
PV Unit electricity exported	-180.4682	0.1235	-22.2818	
Total			-70.2632	(269)
Total CO2, kg/year			276.0827	(272)
CO2 emissions per m2			5.4000	(273)
EI value			96.1532	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		51.1700	(1b)	x 2.4000	(2b) =	122.8080	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.1700						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		122.8080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.0500	1.2357	7.4762			(27)
External Wall 1	16.0600	6.0500	10.0100	0.1400	1.4014	14.0000	140.1400	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	8.8776			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			16.0600	0.0000	0.0000	20.0000	321.2000	(32)
Party Floor 1			51.1700			80.0000	4093.6000	(32d)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			79.3800			9.0000	714.4200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10291.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		201.1288 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.6000	0.0500	0.1300
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.3345 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	10.2121 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.7983	11.7983	11.5628	10.8561	10.7383	10.2672	10.0316	10.0316	10.5027	11.0916	11.3272	11.2094	(38)
Heat transfer coeff	22.0105	22.0105	21.7749	21.0682	20.9504	20.4793	20.2437	20.2437	20.7149	21.3038	21.5393	21.4216	(39)
Average = Sum(39)m / 12 =												21.1467	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4301	0.4301	0.4255	0.4117	0.4094	0.4002	0.3956	0.3956	0.4048	0.4163	0.4209	0.4186	(40)
HLP (average)												0.4133	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.7246 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.0608	71.9628	70.3629	67.3017	65.0426	62.5233	61.0913	62.6791	64.4197	67.1247	70.2516	72.7809	(42a)

Hot water usage for baths

22.9731	22.6319	22.1514	21.2656	20.6022	19.8667	19.4694	19.9465	20.4660	21.2530	22.1571	22.8954	(42b)

Hot water usage for other uses

32.2915	31.1172	29.9430	28.7688	27.5945	26.4203	26.4203	27.5945	28.7688	29.9430	31.1172	32.2915	(42c)

Average daily hot water use (litres/day)		118.0151 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.3253	125.7119	122.4573	117.3360	113.2393	108.8102	106.9810	110.2201	113.6544	118.3207	123.5260	127.9677	(44)
Energy conte	203.2359	179.0121	188.2123	160.6271	152.4419	133.7949	129.3842	136.4755	140.1472	160.5600	175.9854	200.3665	(45)
Energy content (annual)										Total = Sum(45)m =		1960.2433	

Distribution loss (46)m = 0.15 x (45)m

30.4854	26.8518	28.2318	24.0941	22.8663	20.0692	19.4076	20.4713	21.0221	24.0840	26.3978	30.0550	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
									Total per year (kWh/year) = Sum(64)m =			2207.2753	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	84.3606	74.6819	79.3652	69.6517	67.4716	60.7300	59.8049	62.1628	62.8422	70.1708	74.7583	83.4065	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.5665	16.4906	13.4111	10.1530	7.5895	6.4074	6.9234	8.9993	12.0789	15.3369	17.9004	19.0825	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	224.2868	226.6142	220.7492	208.2634	192.5023	177.6891	167.7930	165.4656	171.3306	183.8164	199.5774	214.3906	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	(71)
Water heating gains (Table 5)	113.3879	111.1337	106.6737	96.7385	90.6876	84.3472	80.3829	83.5521	87.2808	94.3157	103.8310	112.1055	(72)
Total internal gains	437.8050	435.8023	422.3978	396.7187	372.3432	350.0075	336.6631	339.5808	352.2540	375.0327	402.8727	427.1425	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	6.0500	33.4622	0.6300	0.8270	0.7700	73.0953	(79)

Solar gains	73.0953	132.8884	190.0221	247.6641	274.5958	264.9514	258.6131	230.4683	203.9112	145.9899	89.9762	63.9718	(83)
Total gains	510.9003	568.6907	612.4199	644.3828	646.9390	614.9590	595.2762	570.0491	556.1652	521.0226	492.8488	491.1143	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	129.8847	129.8847	131.2898	135.6936	136.4565	139.5957	141.2200	141.2200	138.0082	134.1933	132.7257	133.4554	
alpha	9.6590	9.6590	9.7527	10.0462	10.0971	10.3064	10.4147	10.4147	10.2005	9.9462	9.8484	9.8970	
util living area	0.7262	0.6429	0.5469	0.4283	0.3336	0.2598	0.2074	0.2202	0.3054	0.4619	0.6269	0.7426	(86)
MIT	20.9842	20.9943	20.9987	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9998	20.9964	20.9827	(87)
Th 2	20.5853	20.5853	20.5896	20.6024	20.6045	20.6131	20.6174	20.6174	20.6088	20.5981	20.5938	20.5960	(88)
util rest of house	0.7102	0.6276	0.5324	0.4153	0.3207	0.2469	0.1944	0.2066	0.2908	0.4455	0.6097	0.7272	(89)
MIT 2	20.5688	20.5795	20.5883	20.6023	20.6045	20.6131	20.6174	20.6174	20.6088	20.5980	20.5903	20.5778	(90)
Living area fraction										fLA = Living area / (4) =		0.5576	(91)
MIT	20.8004	20.8108	20.8171	20.8240	20.8250	20.8288	20.8307	20.8307	20.8269	20.8220	20.8168	20.8036	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.8004	20.8108	20.8171	20.8240	20.8250	20.8288	20.8307	20.8307	20.8269	20.8220	20.8168	20.8036	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7185	0.6360	0.5404	0.4225	0.3279	0.2541	0.2017	0.2142	0.2990	0.4547	0.6191	0.7352	(94)
Useful gains	367.1006	361.6592	330.9707	272.2579	212.1218	156.2330	120.0602	122.0846	166.2762	236.8899	305.1447	361.0442	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	371.9854	363.4094	331.3518	272.2854	212.1236	156.2331	120.0602	122.0846	166.2767	236.9409	306.2195	366.3847	(97)
Space heating kWh	3.6342	1.1761	0.2835	0.0197	0.0014	0.0000	0.0000	0.0000	0.0000	0.0379	0.7738	3.9733	(98a)
Space heating requirement - total per year (kWh/year)												9.9001	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	3.6342	1.1761	0.2835	0.0197	0.0014	0.0000	0.0000	0.0000	0.0000	0.0379	0.7738	3.9733	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9.9001	
Space heating per m2											(98c) / (4) =	0.1935	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	3.6342	1.1761	0.2835	0.0197	0.0014	0.0000	0.0000	0.0000	0.0000	0.0379	0.7738	3.9733	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													

	3.6342	1.1761	0.2835	0.0197	0.0014	0.0000	0.0000	0.0000	0.0000	0.0379	0.7738	3.9733 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	8.9074	8.0454	8.9074	8.6201	8.9074	8.6201	8.9074	8.9074	8.6201	8.9074	8.6201	8.9074 (231)
Lighting	16.2512	13.0373	11.7386	8.6002	6.6431	5.4274	6.0600	7.8770	10.2315	13.4243	15.1627	16.7028 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-10.9890	-18.6157	-31.6465	-41.8691	-49.0676	-46.3455	-46.0104	-40.5058	-32.7427	-22.8928	-13.0639	-9.4446 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.0488	-5.2230	-12.2849	-22.0132	-30.4827	-30.1706	-30.2222	-23.4005	-15.7615	-7.8062	-2.9515	-1.6281 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	9.9001 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2207.2753 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	104.8780 (230a)
Total electricity for the above, kWh/year	104.8780 (231)
Electricity for lighting (calculated in Appendix L)	131.1561 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-547.1869 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1906.0227 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	9.9001	25.1600	2.4909	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	25.1600	555.3505	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	104.8780	25.1600	26.3873	(249)
Energy for lighting	131.1561	25.1600	32.9989	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1936	25.1600	-91.3795	
PV Unit electricity exported	-183.9933	5.8100	-10.6900	
Total			-102.0695	(252)
Total energy cost			515.1580	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	9.9001	0.1613	1.5966	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2207.2753	0.1413	311.7942	(264)
Space and water heating			313.3909	(265)
Pumps, fans and electric keep-hot	104.8780	0.1387	14.5479	(267)
Energy for lighting	131.1561	0.1443	18.9299	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1936	0.1319	-47.9013	
PV Unit electricity exported	-183.9933	0.1230	-22.6294	
Total			-70.5307	(269)
Total CO2, kg/year			276.3379	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	9.9001	1.5968	15.8083	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	1.5223	3360.2168	(278)
Space and water heating			3376.0251	(279)

Pumps, fans and electric keep-hot	104.8780	1.5128	158.6595	(281)
Energy for lighting	131.1561	1.5338	201.1716	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1936	1.4873	-540.1750	
PV Unit electricity exported	-183.9933	0.4514	-83.0493	
Total			-623.2243	(283)
Total Primary energy kWh/year			3112.6319	(286)

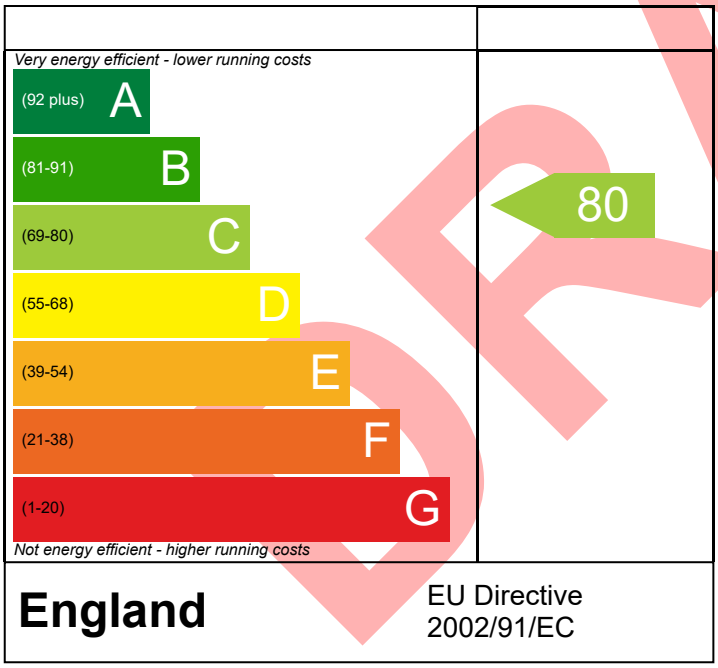
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	51.17 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

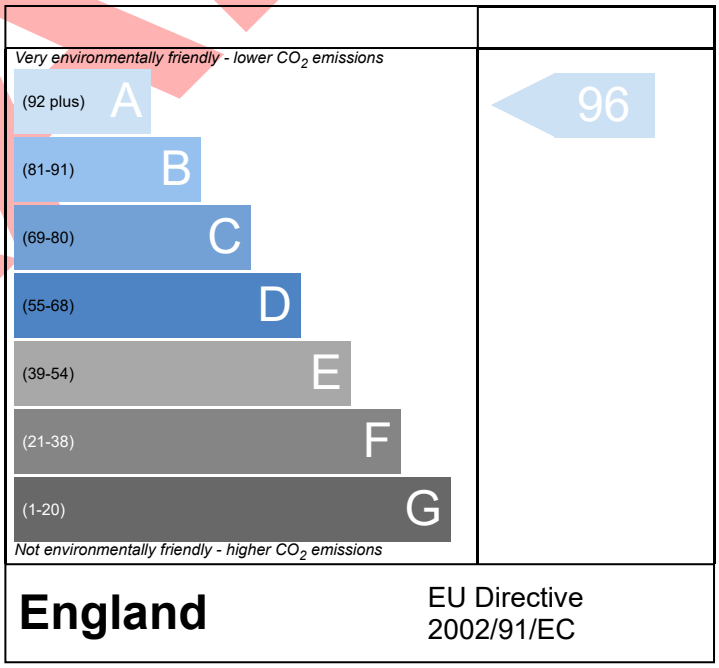
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:18

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	64 m^2
Site Reference	Unit 396 L03_Copy	Plot Reference	Unit 396 L03_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.61 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	5.6 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*62.72 kWh$_{PE}$/m^2*	
Dwelling primary energy	62.24 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*22.8 kWh/m^2*	
Dwelling fabric energy efficiency	23.4 kWh/m^2	FAIL

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	24.52	0.14 **(!)**
Party wall: Party Wall (1)	14.85	0 **(!)**
Party wall: Party Wall (2)	29.36	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	7.88	South West	0.83	1.3
NW, Opening Type 1	11.81	North West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.83 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 396 L03_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 396 L03_Copy	**Prop Type Ref**	Unit 396 L03
Property			

SAP Rating	78 C	**DER**	5.60	**TER**	11.61
Environmental	96 A	**% DER < TER**			51.77
CO_2 Emissions (t/year)	0.36	**DFEE**	23.37	**TFEE**	22.77
Compliance Check	See BREL	**% DFEE < TFEE**			-2.62
% DPER < TPER	0.76	**DPER**	62.24	**TPER**	62.72

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.3100 (1b)	x	2.4000 (2b)	=	154.3440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.3100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	154.3440	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.2100	19.6900	24.5200	0.1400	3.4328	14.0000	343.2800	(29a)
Total net area of external elements Aum(A, m2)			44.2100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.7645			(33)
Party Wall 1			14.8500	0.0000	0.0000	20.0000	297.0000	(32)
Wall to corridor			29.3600	0.0000	0.0000	20.0000	587.2000	(32)
Party Floor 1			64.3100			80.0000	5144.8000	(32d)
Party Ceiling 1			64.3100			80.0000	5144.8000	(32b)
Internal Wall 1			98.7600			9.0000	888.8400	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12405.9200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		192.9081 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240

E4 Jamb	23.2000	0.0500	1.1600	
E7 Party floor between dwellings (in blocks of flats)	16.3700	0.0700	1.1459	
E18 Party wall between dwellings	2.7000	0.0600	0.1620	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	14.9200	0.0000	0.0000	
E16 Corner (normal)	2.7000	0.0900	0.2430	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.1349 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 30.8994 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.4106	15.2482	15.0859	14.2741	14.1118	13.3000	13.3000	13.1377	13.6247	14.1118	14.4365	14.7612	(38)
Heat transfer coeff	46.3100	46.1477	45.9853	45.1736	45.0112	44.1995	44.1995	44.0371	44.5242	45.0112	45.3359	45.6606	(39)
Average = Sum(39)m / 12 =												45.1330	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7201	0.7176	0.7151	0.7024	0.6999	0.6873	0.6873	0.6848	0.6923	0.6999	0.7050	0.7100	(40)
HLP (average)												0.7018	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1005 (42)
Hot water usage for mixer showers

81.7276	80.4994	78.7097	75.2853	72.7583	69.9401	68.3382	70.1144	72.0615	75.0873	78.5852	81.4145	(42a)

Hot water usage for baths

25.6836	25.3022	24.7650	23.7747	23.0331	22.2107	21.7666	22.3000	22.8807	23.7606	24.7714	25.5968	(42b)

Hot water usage for other uses

36.1413	34.8271	33.5129	32.1986	30.8844	29.5702	29.5702	30.8844	32.1986	33.5129	34.8271	36.1413	(42c)

Average daily hot water use (litres/day) 132.0187 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.5526	140.6287	136.9876	131.2586	126.6757	121.7210	119.6750	123.2988	127.1408	132.3608	138.1837	143.1526	(44)
Energy conte	227.3522	200.2534	210.5448	179.6865	170.5299	149.6702	144.7365	152.6697	156.7773	179.6124	196.8681	224.1424	(45)
Energy content (annual)											Total = Sum(45)m =	2192.8435	
Distribution loss (46)m = 0.15 x (45)m	34.1028	30.0380	31.5817	26.9530	25.5795	22.4505	21.7105	22.9004	23.5166	26.9419	29.5302	33.6214	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(64)
									Total per year (kWh/year) = Sum(64)m =		2439.8755	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

92.3793	81.7446	86.7908	75.9890	73.4858	66.0085	64.9095	67.5473	68.3717	76.5058	81.7018	91.3120	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.1424	18.7785	15.2717	11.5617	8.6425	7.2964	7.8840	10.2479	13.7547	17.4647	20.3839	21.7301	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	274.1367	276.9814	269.8129	254.5520	235.2878	217.1823	205.0866	202.2419	209.4104	224.6713	243.9355	262.0411	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(70)
Losses e.g. evaporation (negative values) (Table 5)	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	(71)
Water heating gains (Table 5)	124.1657	121.6437	116.6543	105.5402	98.7713	91.6785	87.2440	90.7894	94.9607	102.8303	113.4748	122.7312	(72)
Total internal gains	511.1586	509.1174	493.4527	463.3677	434.4154	407.8709	391.9284	394.9930	409.8396	436.6802	469.5080	498.2161	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(79)
Northwest	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(81)

Solar gains	152.7958	276.2486	420.4233	592.0739	728.1137	751.4140	712.5556	606.6966	479.1778	316.7586	185.9245	128.8782	(83)
Total gains	663.9545	785.3661	913.8760	1055.4416	1162.5291	1159.2849	1104.4840	1001.6896	889.0173	753.4388	655.4324	627.0944	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	74.4135	74.6752	74.9389	76.2855	76.5607	77.9668	77.9668	78.2542	77.3982	76.5607	76.0123	75.4718	
alpha	5.9609	5.9783	5.9959	6.0857	6.1040	6.1978	6.1978	6.2169	6.1599	6.1040	6.0675	6.0315	
util living area	0.9129	0.8319	0.6961	0.5133	0.3596	0.2440	0.1761	0.2022	0.3452	0.6080	0.8411	0.9285	(86)
MIT	20.6238	20.7983	20.9311	20.9890	20.9988	20.9999	21.0000	21.0000	20.9993	20.9773	20.8219	20.5833	(87)
Th 2	20.3231	20.3253	20.3276	20.3387	20.3409	20.3521	20.3521	20.3543	20.3476	20.3409	20.3365	20.3320	(88)
util rest of house	0.8993	0.8114	0.6697	0.4863	0.3343	0.2193	0.1502	0.1738	0.3127	0.5728	0.8180	0.9169	(89)
MIT 2	19.9049	20.1099	20.2586	20.3287	20.3400	20.3520	20.3521	20.3543	20.3472	20.3210	20.1512	19.8644	(90)
Living area fraction										fLA = Living area / (4) =		0.3816	(91)
MIT	20.1792	20.3726	20.5152	20.5807	20.5914	20.5993	20.5993	20.6007	20.5960	20.5714	20.4071	20.1387	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1792	20.3726	20.5152	20.5807	20.5914	20.5993	20.5993	20.6007	20.5960	20.5714	20.4071	20.1387	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8962	0.8129	0.6772	0.4962	0.3439	0.2287	0.1600	0.1847	0.3251	0.5852	0.8206	0.9132	(94)
Useful gains	595.0388	638.4221	618.8617	523.7474	399.8206	265.1421	176.7657	184.9820	289.0372	440.9435	537.8315	572.6406	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	735.3680	714.0235	644.4936	527.6585	400.2118	265.1640	176.7674	184.9862	289.2306	448.8256	603.2915	727.7727	(97)
Space heating kWh	104.4049	50.8041	19.0701	2.8159	0.2910	0.0000	0.0000	0.0000	0.0000	5.8643	47.1312	115.4183	(98a)
Space heating requirement - total per year (kWh/year)												345.7999	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	104.4049	50.8041	19.0701	2.8159	0.2910	0.0000	0.0000	0.0000	0.0000	5.8643	47.1312	115.4183	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												345.7999	
Space heating per m2											(98c) / (4) =	5.3771	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	104.4049	50.8041	19.0701	2.8159	0.2910	0.0000	0.0000	0.0000	0.0000	5.8643	47.1312	115.4183	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	104.4049	50.8041	19.0701	2.8159	0.2910	0.0000	0.0000	0.0000	0.0000	5.8643	47.1312	115.4183	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.1948	10.1114	11.1948	10.8337	11.1948	10.8337	11.1948	11.1948	10.8337	11.1948	10.8337	11.1948	(231)
Lighting	18.5059	14.8461	13.3673	9.7934	7.5647	6.1804	6.9008	8.9699	11.6510	15.2868	17.2664	19.0202	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.4007	-24.4116	-39.4994	-49.6586	-58.3512	-56.1753	-55.2817	-49.8783	-40.7154	-29.7229	-17.7115	-12.9855	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.8931	-6.9495	-15.7665	-26.5116	-37.1419	-38.1716	-37.6311	-30.4564	-20.7964	-10.9074	-4.1606	-2.2017	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	345.7999	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2439.8755	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	131.8098	(230a)
Total electricity for the above, kWh/year	131.8098	(231)
Electricity for lighting (calculated in Appendix L)	149.3528	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-683.3800	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)

Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2383.4580	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	345.7999	16.4900	57.0224	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2439.8755	16.4900	402.3355	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	131.8098	16.4900	21.7354	(249)
Energy for lighting	149.3528	16.4900	24.6283	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-449.7921	16.4900	-74.1707	
PV Unit electricity exported	-233.5879	5.5900	-13.0576	
Total			-87.2283	(252)
Total energy cost			418.4933	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.3783	(257)
SAP value		77.6584	
SAP rating (Section 12)		78	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	345.7999	0.1597	55.2330	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2439.8755	0.1413	344.7254	(264)
Space and water heating			399.9584	(265)
Pumps, fans and electric keep-hot	131.8098	0.1387	18.2836	(267)
Energy for lighting	149.3528	0.1443	21.5562	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-449.7921	0.1323	-59.5275	
PV Unit electricity exported	-233.5879	0.1231	-28.7646	
Total			-88.2920	(269)
Total CO2, kg/year			351.5063	(272)
CO2 emissions per m2			5.4700	(273)
EI value			95.6910	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		64.3100 (1b)	x	2.4000 (2b)	=	154.3440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.3100						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		154.3440	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.2100	19.6900	24.5200	0.1400	3.4328	14.0000	343.2800	(29a)
Total net area of external elements Aum(A, m2)			44.2100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.7645			(33)
Party Wall 1			14.8500	0.0000	0.0000	20.0000	297.0000	(32)
Wall to corridor			29.3600	0.0000	0.0000	20.0000	587.2000	(32)
Party Floor 1			64.3100			80.0000	5144.8000	(32d)
Party Ceiling 1			64.3100			80.0000	5144.8000	(32b)
Internal Wall 1			98.7600			9.0000	888.8400	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12405.9200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 192.9081 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.3700	0.0700	1.1459
E18 Party wall between dwellings	2.7000	0.0600	0.1620
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	14.9200	0.0000	0.0000
E16 Corner (normal)	2.7000	0.0900	0.2430

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.1349 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 30.8994 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.5729	15.5729	15.2482	14.2741	14.1118	13.4624	13.1377	13.1377	13.7871	14.5988	14.9235	14.7612	(38)
Heat transfer coeff	46.4724	46.4724	46.1477	45.1736	45.0112	44.3618	44.0371	44.0371	44.6865	45.4983	45.8230	45.6606	(39)

Average = Sum(39)m / 12 = 45.2818

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7226	0.7226	0.7176	0.7024	0.6999	0.6898	0.6848	0.6848	0.6949	0.7075	0.7125	0.7100	(40)
HLP (average)												0.7041	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1005 (42)
Hot water usage for mixer showers

81.7276	80.4994	78.7097	75.2853	72.7583	69.9401	68.3382	70.1144	72.0615	75.0873	78.5852	81.4145	(42a)

Hot water usage for baths

25.6836	25.3022	24.7650	23.7747	23.0331	22.2107	21.7666	22.3000	22.8807	23.7606	24.7714	25.5968	(42b)

Hot water usage for other uses

36.1413	34.8271	33.5129	32.1986	30.8844	29.5702	29.5702	30.8844	32.1986	33.5129	34.8271	36.1413	(42c)

Average daily hot water use (litres/day) 132.0187 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.5526	140.6287	136.9876	131.2586	126.6757	121.7210	119.6750	123.2988	127.1408	132.3608	138.1837	143.1526	(44)
Energy conte	227.3522	200.2534	210.5448	179.6865	170.5299	149.6702	144.7365	152.6697	156.7773	179.6124	196.8681	224.1424	(45)
Energy content (annual)											Total = Sum(45)m =	2192.8435	
Distribution loss (46)m = 0.15 x (45)m	34.1028	30.0380	31.5817	26.9530	25.5795	22.4505	21.7105	22.9004	23.5166	26.9419	29.5302	33.6214	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(64)

Total per year (kWh/year) = Sum(64)m = 2439.8755 (64)
Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month

92.3793	81.7446	86.7908	75.9890	73.4858	66.0085	64.9095	67.5473	68.3717	76.5058	81.7018	91.3120	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	21.1424	18.7785	15.2717	11.5617	8.6425	7.2964	7.8840	10.2479	13.7547	17.4647	20.3839	21.7301	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	274.1367	276.9814	269.8129	254.5520	235.2878	217.1823	205.0866	202.2419	209.4104	224.6713	243.9355	262.0411	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	(71)

Water heating gains (Table 5)

	124.1657	121.6437	116.6543	105.5402	98.7713	91.6785	87.2440	90.7894	94.9607	102.8303	113.4748	122.7312	(72)

Total internal gains

	511.1586	509.1174	493.4527	463.3677	434.4154	407.8709	391.9284	394.9930	409.8396	436.6802	469.5080	498.2161	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(79)
Northwest	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(81)

Solar gains	137.9782	265.6866	421.5549	624.1600	760.9473	764.1300	733.2127	606.0620	475.9114	302.5081	172.4386	119.0880	(83)
Total gains	649.1368	774.8041	915.0076	1087.5277	1195.3628	1172.0009	1125.1411	1001.0551	885.7510	739.1883	641.9466	617.3041	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	74.1535	74.1535	74.6752	76.2855	76.5607	77.6814	78.2542	78.2542	77.1170	75.7411	75.2044	75.4718	
alpha	5.9436	5.9436	5.9783	6.0857	6.1040	6.1788	6.2169	6.2169	6.1411	6.0494	6.0136	6.0315	
util living area													
	0.9271	0.8567	0.7305	0.5380	0.3871	0.2951	0.2387	0.2727	0.4126	0.6700	0.8689	0.9400	(86)
MIT	20.5665	20.7475	20.9049	20.9848	20.9980	20.9997	20.9999	20.9999	20.9978	20.9574	20.7701	20.5273	(87)
Th 2	20.3209	20.3209	20.3253	20.3387	20.3409	20.3498	20.3543	20.3543	20.3454	20.3342	20.3298	20.3320	(88)
util rest of house													
	0.9154	0.8384	0.7058	0.5121	0.3626	0.2706	0.2135	0.2443	0.3800	0.6362	0.8486	0.9301	(89)
MIT 2	19.8337	20.0470	20.2278	20.3244	20.3393	20.3496	20.3543	20.3542	20.3438	20.2950	20.0859	19.7960	(90)
Living area fraction										fLA = Living area / (4) =		0.3816	(91)
MIT	20.1133	20.3143	20.4862	20.5764	20.5906	20.5977	20.6007	20.6006	20.5934	20.5478	20.3470	20.0750	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1133	20.3143	20.4862	20.5764	20.5906	20.5977	20.6007	20.6006	20.5934	20.5478	20.3470	20.0750	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9114	0.8382	0.7118	0.5215	0.3719	0.2799	0.2231	0.2551	0.3924	0.6472	0.8492	0.9258	(94)
Useful gains	591.6487	649.4336	651.2843	567.1101	444.5162	328.0844	251.0229	255.4024	347.5726	478.4320	545.1349	571.5150	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	753.4718	744.2246	686.9624	572.6379	445.1895	328.1751	251.0403	255.4414	348.2578	493.5547	629.9265	747.6945	(97)
Space heating kWh													
	120.3964	63.6995	26.5445	3.9801	0.5010	0.0000	0.0000	0.0000	0.0000	11.2513	61.0500	131.0776	(98a)
Space heating requirement - total per year (kWh/year)												418.5003	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	120.3964	63.6995	26.5445	3.9801	0.5010	0.0000	0.0000	0.0000	0.0000	11.2513	61.0500	131.0776	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												418.5003	
Space heating per m2											(98c) / (4) =	6.5075	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	120.3964	63.6995	26.5445	3.9801	0.5010	0.0000	0.0000	0.0000	0.0000	11.2513	61.0500	131.0776	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	120.3964	63.6995	26.5445	3.9801	0.5010	0.0000	0.0000	0.0000	0.0000	11.2513	61.0500	131.0776	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													

	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.1948	10.1114	11.1948	10.8337	11.1948	10.8337	11.1948	11.1948	10.8337	11.1948	10.8337	11.1948	(231)
Lighting	18.5059	14.8461	13.3673	9.7934	7.5647	6.1804	6.9008	8.9699	11.6510	15.2868	17.2664	19.0202	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-13.9632	-23.5442	-39.5900	-51.7924	-60.4179	-56.9935	-56.5645	-49.8935	-40.4465	-28.5276	-16.4999	-12.0106	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4329	-6.4348	-15.6570	-28.5444	-39.6226	-39.2313	-39.3039	-30.4736	-20.5513	-10.0788	-3.6407	-1.9141	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	418.5003	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2439.8755	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	131.8098	(230a)
Total electricity for the above, kWh/year	131.8098	(231)
Electricity for lighting (calculated in Appendix L)	149.3528	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-688.1289	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2451.4094	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	418.5003	25.1600	105.2947	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2439.8755	25.1600	613.8727	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	131.8098	25.1600	33.1633	(249)
Energy for lighting	149.3528	25.1600	37.5772	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-450.2436	25.1600	-113.2813	
PV Unit electricity exported	-237.8853	5.8100	-13.8211	
Total			-127.1024	(252)
Total energy cost			662.8054	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	418.5003	0.1592	66.6275	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2439.8755	0.1413	344.7254	(264)
Space and water heating			411.3529	(265)
Pumps, fans and electric keep-hot	131.8098	0.1387	18.2836	(267)
Energy for lighting	149.3528	0.1443	21.5562	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-450.2436	0.1320	-59.4512	
PV Unit electricity exported	-237.8853	0.1226	-29.1704	
Total			-88.6216	(269)
Total CO2, kg/year			362.5711	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	418.5003	1.5892	665.0908	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2439.8755	1.5225	3714.5924	(278)
Space and water heating			4379.6831	(279)
Pumps, fans and electric keep-hot	131.8098	1.5128	199.4018	(281)
Energy for lighting	149.3528	1.5338	229.0823	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-450.2436	1.4879	-669.9030	
PV Unit electricity exported	-237.8853	0.4500	-107.0542	
Total			-776.9572	(283)
Total Primary energy kWh/year			4031.2101	(286)

SAP 10 EPC IMPROVEMENTS

Unit 396 L03_Copy

Current energy efficiency rating: C 78
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 78
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£790	£790	£0
Space heating	£138	£138	£0
Water heating	£614	£614	£0
Lighting	£38	£38	£0
Generated (PV)	-£127	-£127	£0
Total cost of fuels	£663	£663	£0
Total cost of uses	£663	£663	£0
Delivered energy	38 kWh/m²	38 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	63 kWh/m²	63 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.3100 (1b)	x	2.4000 (2b)	=	154.3440	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.3100					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	154.3440	(5)

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2. Ventilation rate

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	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.2100	19.6900	24.5200	0.1400	3.4328	14.0000	343.2800	(29a)
Total net area of external elements Aum(A, m2)			44.2100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.7645			(33)
Party Wall 1			14.8500	0.0000	0.0000	20.0000	297.0000	(32)
Wall to corridor			29.3600	0.0000	0.0000	20.0000	587.2000	(32)
Party Floor 1			64.3100			80.0000	5144.8000	(32d)
Party Ceiling 1			64.3100			80.0000	5144.8000	(32b)
Internal Wall 1			98.7600			9.0000	888.8400	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12405.9200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 192.9081 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.3700	0.0700	1.1459
E18 Party wall between dwellings	2.7000	0.0600	0.1620
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	14.9200	0.0000	0.0000
E16 Corner (normal)	2.7000	0.0900	0.2430

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.1349 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 30.8994 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.4106	15.2482	15.0859	14.2741	14.1118	13.3000	13.3000	13.1377	13.6247	14.1118	14.4365	14.7612	(38)
Heat transfer coeff	46.3100	46.1477	45.9853	45.1736	45.0112	44.1995	44.1995	44.0371	44.5242	45.0112	45.3359	45.6606	(39)
Average = Sum(39)m / 12 =												45.1330	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7201	0.7176	0.7151	0.7024	0.6999	0.6873	0.6873	0.6848	0.6923	0.6999	0.7050	0.7100	(40)
HLP (average)												0.7018	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1005 (42)
Hot water usage for mixer showers

81.7276	80.4994	78.7097	75.2853	72.7583	69.9401	68.3382	70.1144	72.0615	75.0873	78.5852	81.4145	(42a)

Hot water usage for baths

25.6836	25.3022	24.7650	23.7747	23.0331	22.2107	21.7666	22.3000	22.8807	23.7606	24.7714	25.5968	(42b)

Hot water usage for other uses

36.1413	34.8271	33.5129	32.1986	30.8844	29.5702	29.5702	30.8844	32.1986	33.5129	34.8271	36.1413	(42c)

Average daily hot water use (litres/day) 132.0187 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.5526	140.6287	136.9876	131.2586	126.6757	121.7210	119.6750	123.2988	127.1408	132.3608	138.1837	143.1526	(44)
Energy conte	227.3522	200.2534	210.5448	179.6865	170.5299	149.6702	144.7365	152.6697	156.7773	179.6124	196.8681	224.1424	(45)
Energy content (annual)										Total = Sum(45)m =		2192.8435	
Distribution loss (46)m = 0.15 x (45)m	34.1028	30.0380	31.5817	26.9530	25.5795	22.4505	21.7105	22.9004	23.5166	26.9419	29.5302	33.6214	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(64)
										Total per year (kWh/year) = Sum(64)m =		2439.8755	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	92.3793	81.7446	86.7908	75.9890	73.4858	66.0085	64.9095	67.5473	68.3717	76.5058	81.7018	91.3120	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.1424	18.7785	15.2717	11.5617	8.6425	7.2964	7.8840	10.2479	13.7547	17.4647	20.3839	21.7301	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	274.1367	276.9814	269.8129	254.5520	235.2878	217.1823	205.0866	202.2419	209.4104	224.6713	243.9355	262.0411	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	(71)
Water heating gains (Table 5)	124.1657	121.6437	116.6543	105.5402	98.7713	91.6785	87.2440	90.7894	94.9607	102.8303	113.4748	122.7312	(72)
Total internal gains	511.1586	509.1174	493.4527	463.3677	434.4154	407.8709	391.9284	394.9930	409.8396	436.6802	469.5080	498.2161	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(79)
Northwest	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(81)

Solar gains	152.7958	276.2486	420.4233	592.0739	728.1137	751.4140	712.5556	606.6966	479.1778	316.7586	185.9245	128.8782	(83)
Total gains	663.9545	785.3661	913.8760	1055.4416	1162.5291	1159.2849	1104.4840	1001.6896	889.0173	753.4388	655.4324	627.0944	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	74.4135	74.6752	74.9389	76.2855	76.5607	77.9668	77.9668	78.2542	77.3982	76.5607	76.0123	75.4718	
alpha	5.9609	5.9783	5.9959	6.0857	6.1040	6.1978	6.1978	6.2169	6.1599	6.1040	6.0675	6.0315	
util living area	0.9129	0.8319	0.6961	0.5133	0.3596	0.2440	0.1761	0.2022	0.3452	0.6080	0.8411	0.9285	(86)
MIT	20.6238	20.7983	20.9311	20.9890	20.9988	20.9999	21.0000	21.0000	20.9993	20.9773	20.8219	20.5833	(87)
Th 2	20.3231	20.3253	20.3276	20.3387	20.3409	20.3521	20.3521	20.3543	20.3476	20.3409	20.3365	20.3320	(88)
util rest of house	0.8993	0.8114	0.6697	0.4863	0.3343	0.2193	0.1502	0.1738	0.3127	0.5728	0.8180	0.9169	(89)
MIT 2	19.9049	20.1099	20.2586	20.3287	20.3400	20.3520	20.3521	20.3543	20.3472	20.3210	20.1512	19.8644	(90)
Living area fraction									fLA = Living area / (4) =			0.3816	(91)
MIT	20.1792	20.3726	20.5152	20.5807	20.5914	20.5993	20.5993	20.6007	20.5960	20.5714	20.4071	20.1387	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1792	20.3726	20.5152	20.5807	20.5914	20.5993	20.5993	20.6007	20.5960	20.5714	20.4071	20.1387	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8962	0.8129	0.6772	0.4962	0.3439	0.2287	0.1600	0.1847	0.3251	0.5852	0.8206	0.9132	(94)
Useful gains	595.0388	638.4221	618.8617	523.7474	399.8206	265.1421	176.7657	184.9820	289.0372	440.9435	537.8315	572.6406	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	735.3680	714.0235	644.4936	527.6585	400.2118	265.1640	176.7674	184.9862	289.2306	448.8256	603.2915	727.7727	(97)
Space heating kWh	104.4049	50.8041	19.0701	2.8159	0.2910	0.0000	0.0000	0.0000	0.0000	5.8643	47.1312	115.4183	(98a)
Space heating requirement - total per year (kWh/year)												345.7999	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	104.4049	50.8041	19.0701	2.8159	0.2910	0.0000	0.0000	0.0000	0.0000	5.8643	47.1312	115.4183	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												345.7999	
Space heating per m2											(98c) / (4) =	5.3771	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	104.4049	50.8041	19.0701	2.8159	0.2910	0.0000	0.0000	0.0000	0.0000	5.8643	47.1312	115.4183	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	104.4049	50.8041	19.0701	2.8159	0.2910	0.0000	0.0000	0.0000	0.0000	5.8643	47.1312	115.4183	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.1948	10.1114	11.1948	10.8337	11.1948	10.8337	11.1948	11.1948	10.8337	11.1948	10.8337	11.1948	(231)
Lighting	18.5059	14.8461	13.3673	9.7934	7.5647	6.1804	6.9008	8.9699	11.6510	15.2868	17.2664	19.0202	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.4007	-24.4116	-39.4994	-49.6586	-58.3512	-56.1753	-55.2817	-49.8783	-40.7154	-29.7229	-17.7115	-12.9855	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.8931	-6.9495	-15.7665	-26.5116	-37.1419	-38.1716	-37.6311	-30.4564	-20.7964	-10.9074	-4.1606	-2.2017	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity)

(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year		
Space heating fuel - main system 1	345.7999	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2439.8755	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	131.8098	(230a)
Total electricity for the above, kWh/year	131.8098	(231)
Electricity for lighting (calculated in Appendix L)	149.3528	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-683.3800	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2383.4580	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	345.7999	16.4900	57.0224	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2439.8755	16.4900	402.3355	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	131.8098	16.4900	21.7354	(249)
Energy for lighting	149.3528	16.4900	24.6283	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-449.7921	16.4900	-74.1707	
PV Unit electricity exported	-233.5879	5.5900	-13.0576	
Total			-87.2283	(252)
Total energy cost			418.4933	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.3783	(257)
SAP value	77.6584	
SAP rating (Section 12)	78	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	345.7999	0.1597	55.2330	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2439.8755	0.1413	344.7254	(264)
Space and water heating			399.9584	(265)
Pumps, fans and electric keep-hot	131.8098	0.1387	18.2836	(267)
Energy for lighting	149.3528	0.1443	21.5562	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-449.7921	0.1323	-59.5275	
PV Unit electricity exported	-233.5879	0.1231	-28.7646	
Total			-88.2920	(269)
Total CO2, kg/year			351.5063	(272)
CO2 emissions per m2			5.4700	(273)
EI value			95.6910	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		64.3100 (1b)	x	2.4000 (2b)	=	154.3440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.3100						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		154.3440	(5)

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2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.2100	19.6900	24.5200	0.1400	3.4328	14.0000	343.2800	(29a)
Total net area of external elements Aum(A, m2)			44.2100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.7645			(33)
Party Wall 1			14.8500	0.0000	0.0000	20.0000	297.0000	(32)
Wall to corridor			29.3600	0.0000	0.0000	20.0000	587.2000	(32)
Party Floor 1			64.3100			80.0000	5144.8000	(32d)
Party Ceiling 1			64.3100			80.0000	5144.8000	(32b)
Internal Wall 1			98.7600			9.0000	888.8400	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12405.9200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		192.9081 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.3700	0.0700	1.1459
E18 Party wall between dwellings	2.7000	0.0600	0.1620
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	14.9200	0.0000	0.0000
E16 Corner (normal)	2.7000	0.0900	0.2430

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.1349 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	30.8994 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.5729	15.5729	15.2482	14.2741	14.1118	13.4624	13.1377	13.1377	13.7871	14.5988	14.9235	14.7612	(38)
Heat transfer coeff	46.4724	46.4724	46.1477	45.1736	45.0112	44.3618	44.0371	44.0371	44.6865	45.4983	45.8230	45.6606	(39)
Average = Sum(39)m / 12 =												45.2818	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7226	0.7226	0.7176	0.7024	0.6999	0.6898	0.6848	0.6848	0.6949	0.7075	0.7125	0.7100	(40)
HLP (average)												0.7041	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.1005 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
81.7276	80.4994	78.7097	75.2853	72.7583	69.9401	68.3382	70.1144	72.0615	75.0873	78.5852	81.4145	(42a)

Hot water usage for baths

25.6836	25.3022	24.7650	23.7747	23.0331	22.2107	21.7666	22.3000	22.8807	23.7606	24.7714	25.5968	(42b)

Hot water usage for other uses

36.1413	34.8271	33.5129	32.1986	30.8844	29.5702	29.5702	30.8844	32.1986	33.5129	34.8271	36.1413	(42c)

Average daily hot water use (litres/day)	132.0187 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.5526	140.6287	136.9876	131.2586	126.6757	121.7210	119.6750	123.2988	127.1408	132.3608	138.1837	143.1526	(44)
Energy conte	227.3522	200.2534	210.5448	179.6865	170.5299	149.6702	144.7365	152.6697	156.7773	179.6124	196.8681	224.1424	(45)
Energy content (annual)										Total = Sum(45)m =		2192.8435	
Distribution loss (46)m = 0.15 x (45)m	34.1028	30.0380	31.5817	26.9530	25.5795	22.4505	21.7105	22.9004	23.5166	26.9419	29.5302	33.6214	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(64)
									Total per year (kWh/year) = Sum(64)m =			2439.8755	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month													
	92.3793	81.7446	86.7908	75.9890	73.4858	66.0085	64.9095	67.5473	68.3717	76.5058	81.7018	91.3120	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.1424	18.7785	15.2717	11.5617	8.6425	7.2964	7.8840	10.2479	13.7547	17.4647	20.3839	21.7301	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	274.1367	276.9814	269.8129	254.5520	235.2878	217.1823	205.0866	202.2419	209.4104	224.6713	243.9355	262.0411	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	(71)
Water heating gains (Table 5)													
	124.1657	121.6437	116.6543	105.5402	98.7713	91.6785	87.2440	90.7894	94.9607	102.8303	113.4748	122.7312	(72)
Total internal gains													
	511.1586	509.1174	493.4527	463.3677	434.4154	407.8709	391.9284	394.9930	409.8396	436.6802	469.5080	498.2161	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(79)
Northwest	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(81)

Solar gains	137.9782	265.6866	421.5549	624.1600	760.9473	764.1300	733.2127	606.0620	475.9114	302.5081	172.4386	119.0880	(83)
Total gains	649.1368	774.8041	915.0076	1087.5277	1195.3628	1172.0009	1125.1411	1001.0551	885.7510	739.1883	641.9466	617.3041	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	74.1535	74.1535	74.6752	76.2855	76.5607	77.6814	78.2542	78.2542	77.1170	75.7411	75.2044	75.4718	
alpha	5.9436	5.9436	5.9783	6.0857	6.1040	6.1788	6.2169	6.2169	6.1411	6.0494	6.0136	6.0315	
util living area													
	0.9271	0.8567	0.7305	0.5380	0.3871	0.2951	0.2387	0.2727	0.4126	0.6700	0.8689	0.9400	(86)
MIT	20.5665	20.7475	20.9049	20.9848	20.9980	20.9997	20.9999	20.9999	20.9978	20.9574	20.7701	20.5273	(87)
Th 2	20.3209	20.3209	20.3253	20.3387	20.3409	20.3498	20.3543	20.3543	20.3454	20.3342	20.3298	20.3320	(88)
util rest of house													
	0.9154	0.8384	0.7058	0.5121	0.3626	0.2706	0.2135	0.2443	0.3800	0.6362	0.8486	0.9301	(89)
MIT 2	19.8337	20.0470	20.2278	20.3244	20.3393	20.3496	20.3543	20.3542	20.3438	20.2950	20.0859	19.7960	(90)
Living area fraction										fLA = Living area / (4) =		0.3816	(91)
MIT	20.1133	20.3143	20.4862	20.5764	20.5906	20.5977	20.6007	20.6006	20.5934	20.5478	20.3470	20.0750	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1133	20.3143	20.4862	20.5764	20.5906	20.5977	20.6007	20.6006	20.5934	20.5478	20.3470	20.0750	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9114	0.8382	0.7118	0.5215	0.3719	0.2799	0.2231	0.2551	0.3924	0.6472	0.8492	0.9258	(94)
Useful gains	591.6487	649.4336	651.2843	567.1101	444.5162	328.0844	251.0229	255.4024	347.5726	478.4320	545.1349	571.5150	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	753.4718	744.2246	686.9624	572.6379	445.1895	328.1751	251.0403	255.4414	348.2578	493.5547	629.9265	747.6945	(97)
Space heating kWh													
	120.3964	63.6995	26.5445	3.9801	0.5010	0.0000	0.0000	0.0000	0.0000	11.2513	61.0500	131.0776	(98a)
Space heating requirement - total per year (kWh/year)												418.5003	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	120.3964	63.6995	26.5445	3.9801	0.5010	0.0000	0.0000	0.0000	0.0000	11.2513	61.0500	131.0776	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												418.5003	
Space heating per m2											(98c) / (4) =	6.5075	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	120.3964	63.6995	26.5445	3.9801	0.5010	0.0000	0.0000	0.0000	0.0000	11.2513	61.0500	131.0776	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	120.3964	63.6995	26.5445	3.9801	0.5010	0.0000	0.0000	0.0000	0.0000	11.2513	61.0500	131.0776	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.1948	10.1114	11.1948	10.8337	11.1948	10.8337	11.1948	11.1948	10.8337	11.1948	10.8337	11.1948	(231)
Lighting	18.5059	14.8461	13.3673	9.7934	7.5647	6.1804	6.9008	8.9699	11.6510	15.2868	17.2664	19.0202	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-13.9632	-23.5442	-39.5900	-51.7924	-60.4179	-56.9935	-56.5645	-49.8935	-40.4465	-28.5276	-16.4999	-12.0106	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4329	-6.4348	-15.6570	-28.5444	-39.6226	-39.2313	-39.3039	-30.4736	-20.5513	-10.0788	-3.6407	-1.9141	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1	418.5003	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2439.8755	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	131.8098	(230a)
Total electricity for the above, kWh/year	131.8098	(231)
Electricity for lighting (calculated in Appendix L)	149.3528	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-688.1289	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2451.4094	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	418.5003	25.1600	105.2947	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2439.8755	25.1600	613.8727	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	131.8098	25.1600	33.1633	(249)
Energy for lighting	149.3528	25.1600	37.5772	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-450.2436	25.1600	-113.2813	
PV Unit electricity exported	-237.8853	5.8100	-13.8211	
Total			-127.1024	(252)
Total energy cost			662.8054	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	418.5003	0.1592	66.6275	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2439.8755	0.1413	344.7254	(264)
Space and water heating			411.3529	(265)
Pumps, fans and electric keep-hot	131.8098	0.1387	18.2836	(267)
Energy for lighting	149.3528	0.1443	21.5562	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-450.2436	0.1320	-59.4512	
PV Unit electricity exported	-237.8853	0.1226	-29.1704	
Total			-88.6216	(269)
Total CO2, kg/year			362.5711	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	418.5003	1.5892	665.0908	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2439.8755	1.5225	3714.5924	(278)
Space and water heating			4379.6831	(279)
Pumps, fans and electric keep-hot	131.8098	1.5128	199.4018	(281)
Energy for lighting	149.3528	1.5338	229.0823	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-450.2436	1.4879	-669.9030	
PV Unit electricity exported	-237.8853	0.4500	-107.0542	
Total			-776.9572	(283)
Total Primary energy kWh/year			4031.2101	(286)

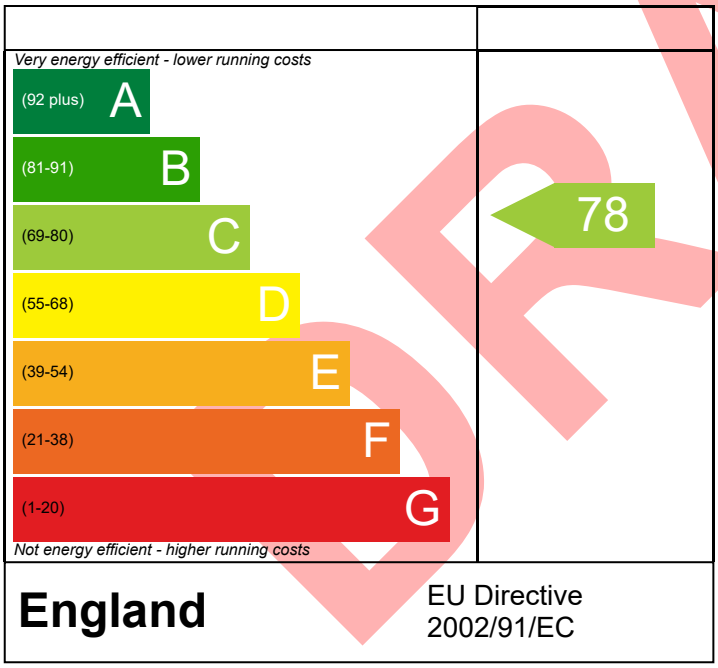
Predicted Energy Assessment

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	64.31 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

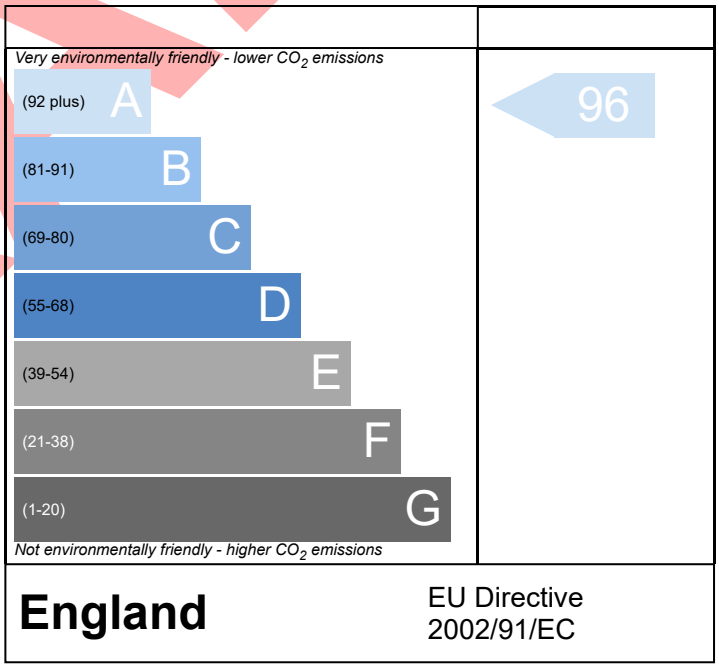
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:20

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	46 m^2
Site Reference	Unit 397 L03_Copy	Plot Reference	Unit 397 L03_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.91 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	4.99 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*64.84 kWh$_{PE}$/m^2*	
Dwelling primary energy	58.98 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*13.1 kWh/m^2*	
Dwelling fabric energy efficiency	12.0 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	8.88	0.14 **(!)**
Party wall: Party Wall (1)	23.22	0 **(!)**
Party wall: Party Wall (2)	39.28	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	7.18	South West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.95 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 397 L03_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 397 L03_Copy	**Prop Type Ref**	Unit 397 L03
Property			

SAP Rating	81 B	**DER**	4.99	**TER**	11.91
Environmental	97 A	**% DER < TER**			58.10
CO_2 Emissions (t/year)	0.23	**DFEE**	12.01	**TFEE**	13.06
Compliance Check	See BREL	**% DFEE < TFEE**			8.05
% DPER < TPER	9.04	**DPER**	58.98	**TPER**	64.84

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		45.9900 (1b)	x	2.4000 (2b)	=	110.3760	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.9900						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	110.3760	(5)

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2. Ventilation rate

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	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.1800	1.2357	8.8726			(27)
External Wall 1	16.0600	7.1800	8.8800	0.1400	1.2432	14.0000	124.3200	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.1158			(33)
Party Wall 1			23.2200	0.0000	0.0000	20.0000	464.4000	(32)
Wall to corridor			39.2800	0.0000	0.0000	20.0000	785.6000	(32)
Party Floor 1			45.9900			80.0000	3679.2000	(32d)
Party Ceiling 1			45.9900			80.0000	3679.2000	(32b)
Internal Wall 1			66.6300			9.0000	599.6700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9332.3900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.9222 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695

E4 Jamb	9.2800	0.0500	0.4640	
E7 Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165	
E18 Party wall between dwellings	2.7000	0.0600	0.1620	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.2120 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 11.3278 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	10.4981	10.3922	10.2864	9.7571	9.6512	9.1220	9.1220	9.0161	9.3337	9.6512	9.8630	10.0747	(38)
Heat transfer coeff	21.8259	21.7201	21.6142	21.0849	20.9791	20.4498	20.4498	20.3439	20.6615	20.9791	21.1908	21.4025	(39)

Average = Sum(39)m / 12 = 21.0585

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4746	0.4723	0.4700	0.4585	0.4562	0.4447	0.4447	0.4424	0.4493	0.4562	0.4608	0.4654	(40)
HLP (average)												0.4579	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.5731 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	69.5673	68.5219	66.9984	64.0836	61.9325	59.5337	58.1702	59.6821	61.3394	63.9151	66.8925	69.3008	(42a)
Hot water usage for baths	21.8805	21.5555	21.0979	20.2542	19.6224	18.9219	18.5435	18.9979	19.4926	20.2422	21.1034	21.8065	(42b)
Hot water usage for other uses	30.7397	29.6219	28.5041	27.3863	26.2684	25.1506	25.1506	26.2684	27.3863	28.5041	29.6219	30.7397	(42c)

Average daily hot water use (litres/day) 112.3706 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	122.1875	119.6993	116.6004	111.7240	107.8234	103.6062	101.8643	104.9484	108.2183	112.6614	117.6177	121.8470	(44)
Energy conte	193.5151	170.4502	179.2105	152.9446	145.1510	127.3959	123.1960	129.9480	133.4440	152.8804	167.5680	190.7830	(45)

Energy content (annual) Total = Sum(45)m = 1866.4867

Distribution loss (46)m = 0.15 x (45)m	29.0273	25.5675	26.8816	22.9417	21.7726	19.1094	18.4794	19.4922	20.0166	22.9321	25.1352	28.6174	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(64)

Total per year (kWh/year) = Sum(64)m = 2113.5187 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	81.1284	71.8350	76.3721	67.0973	65.0473	58.6023	57.7473	59.9924	60.6133	67.6174	71.9596	80.2200	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.0271	14.2351	11.5768	8.7644	6.5515	5.5310	5.9765	7.7684	10.4268	13.2392	15.4521	16.4725	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	204.2328	206.3521	201.0115	189.6421	175.2902	161.8015	152.7902	150.6709	156.0115	167.3809	181.7328	195.2215	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	(71)
Water heating gains (Table 5)	109.0436	106.8973	102.6507	93.1907	87.4292	81.3921	77.6173	80.6349	84.1852	90.8836	99.9438	107.8225	(72)
Total internal gains	406.7760	404.9571	392.7115	369.0697	346.7435	326.1972	313.8566	316.5468	328.0960	348.9762	374.6012	396.9891	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.1800	36.7938	0.6300	0.8270	0.7700	95.3847	(79)

Solar gains	95.3847	162.4755	222.3060	275.4479	308.5246	306.2935	295.2996	270.6229	240.7104	179.5700	114.2489	81.6294	(83)
Total gains	502.1607	567.4325	615.0175	644.5176	655.2681	632.4907	609.1562	587.1697	568.8063	528.5462	488.8501	478.6185	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	118.7730	119.3519	119.9364	122.9471	123.5675	126.7657	126.7657	127.4253	125.4668	123.5675	122.3329	121.1228	
alpha	8.9182	8.9568	8.9958	9.1965	9.2378	9.4510	9.4510	9.4950	9.3645	9.2378	9.1555	9.0749	
util living area													
	0.7139	0.6132	0.5090	0.3958	0.2977	0.2069	0.1477	0.1594	0.2506	0.4127	0.6002	0.7365	(86)
MIT	20.9808	20.9943	20.9989	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9999	20.9963	20.9773	(87)
Th 2	20.5442	20.5463	20.5484	20.5590	20.5612	20.5718	20.5718	20.5740	20.5676	20.5612	20.5569	20.5527	(88)
util rest of house													
	0.6964	0.5965	0.4933	0.3814	0.2837	0.1931	0.1333	0.1446	0.2349	0.3953	0.5816	0.7193	(89)
MIT 2	20.5244	20.5406	20.5473	20.5590	20.5612	20.5718	20.5718	20.5740	20.5676	20.5611	20.5534	20.5290	(90)
Living area fraction										fLA = Living area / (4) =		0.5849	(91)
MIT	20.7914	20.8060	20.8114	20.8169	20.8178	20.8223	20.8223	20.8232	20.8205	20.8177	20.8125	20.7912	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7914	20.8060	20.8114	20.8169	20.8178	20.8223	20.8223	20.8232	20.8205	20.8177	20.8125	20.7912	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7060	0.6060	0.5024	0.3898	0.2919	0.2012	0.1417	0.1533	0.2441	0.4055	0.5923	0.7285	(94)
Useful gains	354.5074	343.8804	309.0123	251.2398	191.2823	127.2439	86.3444	89.9842	138.8553	214.3281	289.5660	348.6732	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	359.9391	345.4791	309.3302	251.2663	191.2838	127.2440	86.3444	89.9842	138.8555	214.3586	290.5780	355.0941	(97)
Space heating kWh													
	4.0412	1.0743	0.2365	0.0191	0.0012	0.0000	0.0000	0.0000	0.0000	0.0227	0.7287	4.7771	(98a)
Space heating requirement - total per year (kWh/year)												10.9008	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	4.0412	1.0743	0.2365	0.0191	0.0012	0.0000	0.0000	0.0000	0.0000	0.0227	0.7287	4.7771	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												10.9008	
Space heating per m2											(98c) / (4) =	0.2370	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	4.0412	1.0743	0.2365	0.0191	0.0012	0.0000	0.0000	0.0000	0.0000	0.0227	0.7287	4.7771	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	4.0412	1.0743	0.2365	0.0191	0.0012	0.0000	0.0000	0.0000	0.0000	0.0227	0.7287	4.7771	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.0057	7.2310	8.0057	7.7475	8.0057	7.7475	8.0057	8.0057	7.7475	8.0057	7.7475	8.0057	(231)
Lighting	14.0284	11.2541	10.1331	7.4239	5.7345	4.6851	5.2312	6.7997	8.8321	11.5882	13.0888	14.4183	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.7161	-26.1824	-42.0244	-52.2243	-60.7154	-58.1899	-57.2669	-52.1119	-43.0571	-31.9504	-19.2097	-14.1333	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-4.2226	-9.7128	-21.2318	-34.9585	-48.5839	-49.7975	-49.0791	-39.8374	-27.3480	-14.5542	-5.8247	-3.2497	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	10.9008	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2113.5187	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	94.2611	(230a)
Total electricity for the above, kWh/year	94.2611	(231)
Electricity for lighting (calculated in Appendix L)	113.2174	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-782.1819	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1549.7161	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	10.9008	16.4900	1.7975	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2113.5187	16.4900	348.5192	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	94.2611	16.4900	15.5437	(249)
Energy for lighting	113.2174	16.4900	18.6696	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-473.7818	16.4900	-78.1266	
PV Unit electricity exported	-308.4001	5.5900	-17.2396	
Total			-95.3662	(252)
Total energy cost			289.1638	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1441	(257)
SAP value		81.4546	
SAP rating (Section 12)		81	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	10.9008	0.1616	1.7615	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2113.5187	0.1412	298.5203	(264)
Space and water heating			300.2818	(265)
Pumps, fans and electric keep-hot	94.2611	0.1387	13.0752	(267)
Energy for lighting	113.2174	0.1443	16.3408	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-473.7818	0.1326	-62.8047	
PV Unit electricity exported	-308.4001	0.1237	-38.1446	
Total			-100.9493	(269)
Total CO2, kg/year			228.7484	(272)
CO2 emissions per m2			4.9700	(273)
EI value			96.6312	
EI rating			97	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		45.9900 (1b)	x	2.4000 (2b)	=	110.3760	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.9900						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	110.3760	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.1800	1.2357	8.8726			(27)
External Wall 1	16.0600	7.1800	8.8800	0.1400	1.2432	14.0000	124.3200	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.1158			(33)
Party Wall 1			23.2200	0.0000	0.0000	20.0000	464.4000	(32)
Wall to corridor			39.2800	0.0000	0.0000	20.0000	785.6000	(32)
Party Floor 1			45.9900			80.0000	3679.2000	(32d)
Party Ceiling 1			45.9900			80.0000	3679.2000	(32b)
Internal Wall 1			66.6300			9.0000	599.6700	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9332.3900 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 202.9222 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4	Jamb	9.2800	0.0500	0.4640
E7	Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165
E18	Party wall between dwellings	2.7000	0.0600	0.1620
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.2120 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 11.3278 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	10.6040	10.6040	10.3922	9.7571	9.6512	9.2278	9.0161	9.0161	9.4395	9.9688	10.1805	10.0747	(38)
Heat transfer coeff	21.9318	21.9318	21.7201	21.0849	20.9791	20.5556	20.3439	20.3439	20.7674	21.2966	21.5084	21.4025	(39)

Average = Sum(39)m / 12 = 21.1555

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4769	0.4769	0.4723	0.4585	0.4562	0.4470	0.4424	0.4424	0.4516	0.4631	0.4677	0.4654	(40)
HLP (average)												0.4600	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.5731 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	69.5673	68.5219	66.9984	64.0836	61.9325	59.5337	58.1702	59.6821	61.3394	63.9151	66.8925	69.3008	(42a)
Hot water usage for baths	21.8805	21.5555	21.0979	20.2542	19.6224	18.9219	18.5435	18.9979	19.4926	20.2422	21.1034	21.8065	(42b)
Hot water usage for other uses	30.7397	29.6219	28.5041	27.3863	26.2684	25.1506	25.1506	26.2684	27.3863	28.5041	29.6219	30.7397	(42c)

Average daily hot water use (litres/day) 112.3706 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	122.1875	119.6993	116.6004	111.7240	107.8234	103.6062	101.8643	104.9484	108.2183	112.6614	117.6177	121.8470	(44)
Energy conte	193.5151	170.4502	179.2105	152.9446	145.1510	127.3959	123.1960	129.9480	133.4440	152.8804	167.5680	190.7830	(45)
Energy content (annual)										Total = Sum(45)m =		1866.4867	
Distribution loss (46)m = 0.15 x (45)m	29.0273	25.5675	26.8816	22.9417	21.7726	19.1094	18.4794	19.4922	20.0166	22.9321	25.1352	28.6174	(46)

Water storage loss:

Store volume 143.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)

Temperature factor from Table 2b 0.6000 (49)

Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(64)
									Total per year (kWh/year) = Sum(64)m =			2113.5187	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	81.1284	71.8350	76.3721	67.0973	65.0473	58.6023	57.7473	59.9924	60.6133	67.6174	71.9596	80.2200	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.0271	14.2351	11.5768	8.7644	6.5515	5.5310	5.9765	7.7684	10.4268	13.2392	15.4521	16.4725	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	204.2328	206.3521	201.0115	189.6421	175.2902	161.8015	152.7902	150.6709	156.0115	167.3809	181.7328	195.2215	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	(71)
Water heating gains (Table 5)													
	109.0436	106.8973	102.6507	93.1907	87.4292	81.3921	77.6173	80.6349	84.1852	90.8836	99.9438	107.8225	(72)
Total internal gains													
	406.7760	404.9571	392.7115	369.0697	346.7435	326.1972	313.8566	316.5468	328.0960	348.9762	374.6012	396.9891	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.1800	33.4622	0.6300	0.8270	0.7700	86.7478	(79)

Solar gains	86.7478	157.7089	225.5139	293.9220	325.8839	314.4382	306.9161	273.5144	241.9971	173.2574	106.7816	75.9203	(83)
Total gains	493.5238	562.6659	618.2254	662.9917	672.6273	640.6354	620.7726	590.0612	570.0931	522.2336	481.3828	472.9094	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	118.1997	118.1997	119.3519	122.9471	123.5675	126.1129	127.4253	127.4253	124.8272	121.7249	120.5267	121.1228	
alpha	8.8800	8.8800	8.9568	9.1965	9.2378	9.4075	9.4950	9.4950	9.3218	9.1150	9.0351	9.0749	
util living area													
	0.7428	0.6458	0.5400	0.4165	0.3212	0.2503	0.1999	0.2138	0.2987	0.4606	0.6391	0.7628	(86)
MIT	20.9731	20.9908	20.9980	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9996	20.9933	20.9694	(87)
Th 2	20.5421	20.5421	20.5463	20.5590	20.5612	20.5697	20.5740	20.5740	20.5654	20.5548	20.5506	20.5527	(88)
util rest of house													
	0.7256	0.6290	0.5243	0.4025	0.3076	0.2365	0.1859	0.1991	0.2829	0.4425	0.6200	0.7461	(89)
MIT 2	20.5139	20.5327	20.5443	20.5589	20.5612	20.5697	20.5740	20.5740	20.5654	20.5545	20.5440	20.5204	(90)
Living area fraction										fLA = Living area / (4) =		0.5849	(91)
MIT	20.7824	20.8007	20.8097	20.8168	20.8178	20.8214	20.8232	20.8232	20.8196	20.8149	20.8068	20.7830	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7824	20.8007	20.8097	20.8168	20.8178	20.8214	20.8232	20.8232	20.8196	20.8149	20.8068	20.7830	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7347	0.6386	0.5335	0.4107	0.3156	0.2445	0.1941	0.2077	0.2921	0.4531	0.6309	0.7548	(94)
Useful gains	362.6064	359.2916	329.7927	272.3050	212.2593	156.6621	120.5001	122.5345	166.5448	236.6137	303.7082	356.9401	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	370.2621	361.8891	330.3553	272.3499	212.2627	156.6623	120.5001	122.5345	166.5461	236.7092	305.5653	365.6195	(97)
Space heating kWh													
	5.6959	1.7455	0.4185	0.0323	0.0025	0.0000	0.0000	0.0000	0.0000	0.0710	1.3371	6.4575	(98a)
Space heating requirement - total per year (kWh/year)												15.7604	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	5.6959	1.7455	0.4185	0.0323	0.0025	0.0000	0.0000	0.0000	0.0000	0.0710	1.3371	6.4575	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												15.7604	
Space heating per m2										(98c) / (4) =		0.3427	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	5.6959	1.7455	0.4185	0.0323	0.0025	0.0000	0.0000	0.0000	0.0000	0.0710	1.3371	6.4575	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	5.6959	1.7455	0.4185	0.0323	0.0025	0.0000	0.0000	0.0000	0.0000	0.0710	1.3371	6.4575	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.0057	7.2310	8.0057	7.7475	8.0057	7.7475	8.0057	8.0057	7.7475	8.0057	7.7475	8.0057	(231)

Lighting	14.0284	11.2541	10.1331	7.4239	5.7345	4.6851	5.2312	6.7997	8.8321	11.5882	13.0888	14.4183	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.1735	-25.2163	-42.0172	-54.3084	-62.7136	-58.9778	-58.5016	-52.1268	-42.7872	-30.6548	-17.8872	-13.0808	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.5931	-9.0969	-21.2173	-37.6435	-51.7907	-51.1590	-51.2273	-39.8596	-27.0295	-13.5333	-5.1652	-2.8571	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	15.7604	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2113.5187	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	94.2611	(230a)
Total electricity for the above, kWh/year	94.2611	(231)
Electricity for lighting (calculated in Appendix L)	113.2174	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-787.6175	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1549.1401	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	15.7604	25.1600	3.9653	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2113.5187	25.1600	531.7613	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	94.2611	25.1600	23.7161	(249)
Energy for lighting	113.2174	25.1600	28.4855	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-473.4451	25.1600	-119.1188	
PV Unit electricity exported	-314.1723	5.8100	-18.2534	
Total			-137.3722	(252)
Total energy cost			450.5560	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	15.7604	0.1612	2.5408	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2113.5187	0.1412	298.5203	(264)
Space and water heating			301.0612	(265)
Pumps, fans and electric keep-hot	94.2611	0.1387	13.0752	(267)
Energy for lighting	113.2174	0.1443	16.3408	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-473.4451	0.1322	-62.6123	
PV Unit electricity exported	-314.1723	0.1232	-38.7054	
Total			-101.3177	(269)
Total CO2, kg/year			229.1594	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	15.7604	1.5966	25.1627	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2113.5187	1.5223	3217.3749	(278)
Space and water heating			3242.5376	(279)
Pumps, fans and electric keep-hot	94.2611	1.5128	142.5982	(281)
Energy for lighting	113.2174	1.5338	173.6566	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-473.4451	1.4886	-704.7902	
PV Unit electricity exported	-314.1723	0.4521	-142.0521	
Total			-846.8422	(283)
Total Primary energy kWh/year			2711.9503	(286)

SAP 10 EPC IMPROVEMENTS

Unit 397 L03_Copy

Current energy efficiency rating: B 81
Current environmental impact rating: A 97

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: B 81
Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£588	£588	£0
Space heating	£28	£28	£0
Water heating	£532	£532	£0
Lighting	£28	£28	£0
Generated (PV)	-£137	-£137	£0
Total cost of fuels	£451	£451	£0
Total cost of uses	£451	£451	£0
Delivered energy	34 kWh/m²	34 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.2 tonnes	0.2 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	59 kWh/m²	59 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.9900 (1b)	x	2.4000 (2b)	=	110.3760	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.9900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	110.3760	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.1800	1.2357	8.8726			(27)
External Wall 1	16.0600	7.1800	8.8800	0.1400	1.2432	14.0000	124.3200	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	10.1158			(33)
Party Wall 1			23.2200	0.0000	0.0000	20.0000	464.4000	(32)
Wall to corridor			39.2800	0.0000	0.0000	20.0000	785.6000	(32)
Party Floor 1			45.9900			80.0000	3679.2000	(32d)
Party Ceiling 1			45.9900			80.0000	3679.2000	(32b)
Internal Wall 1			66.6300			9.0000	599.6700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9332.3900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.9222 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165
E18 Party wall between dwellings	2.7000	0.0600	0.1620
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.2120 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	11.3278 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	10.4981	10.3922	10.2864	9.7571	9.6512	9.1220	9.1220	9.0161	9.3337	9.6512	9.8630	10.0747	(38)
Heat transfer coeff	21.8259	21.7201	21.6142	21.0849	20.9791	20.4498	20.4498	20.3439	20.6615	20.9791	21.1908	21.4025	(39)
Average = Sum(39)m / 12 =												21.0585	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4746	0.4723	0.4700	0.4585	0.4562	0.4447	0.4447	0.4424	0.4493	0.4562	0.4608	0.4654	(40)
HLP (average)												0.4579	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.5731 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
69.5673	68.5219	66.9984	64.0836	61.9325	59.5337	58.1702	59.6821	61.3394	63.9151	66.8925	69.3008	(42a)

Hot water usage for baths

21.8805	21.5555	21.0979	20.2542	19.6224	18.9219	18.5435	18.9979	19.4926	20.2422	21.1034	21.8065	(42b)

Hot water usage for other uses

30.7397	29.6219	28.5041	27.3863	26.2684	25.1506	25.1506	26.2684	27.3863	28.5041	29.6219	30.7397	(42c)

Average daily hot water use (litres/day)		112.3706 (43)

Daily hot water use

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
122.1875	119.6993	116.6004	111.7240	107.8234	103.6062	101.8643	104.9484	108.2183	112.6614	117.6177	121.8470	(44)
Energy conte 193.5151	170.4502	179.2105	152.9446	145.1510	127.3959	123.1960	129.9480	133.4440	152.8804	167.5680	190.7830	(45)

Energy content (annual)	Total = Sum(45)m =	1866.4867

Distribution loss (46)m = 0.15 x (45)m

29.0273	25.5675	26.8816	22.9417	21.7726	19.1094	18.4794	19.4922	20.0166	22.9321	25.1352	28.6174	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(64)

	Total per year (kWh/year) = Sum(64)m =	2113.5187 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000 (64a)

Heat gains from water heating, kWh/month

81.1284	71.8350	76.3721	67.0973	65.0473	58.6023	57.7473	59.9924	60.6133	67.6174	71.9596	80.2200	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m 94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

16.0271	14.2351	11.5768	8.7644	6.5515	5.5310	5.9765	7.7684	10.4268	13.2392	15.4521	16.4725	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

204.2328	206.3521	201.0115	189.6421	175.2902	161.8015	152.7902	150.6709	156.0115	167.3809	181.7328	195.2215	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	(71)

Water heating gains (Table 5)

109.0436	106.8973	102.6507	93.1907	87.4292	81.3921	77.6173	80.6349	84.1852	90.8836	99.9438	107.8225	(72)

Total internal gains

406.7760	404.9571	392.7115	369.0697	346.7435	326.1972	313.8566	316.5468	328.0960	348.9762	374.6012	396.9891	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.1800	36.7938	0.6300	0.8270	0.7700	95.3847	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	95.3847	162.4755	222.3060	275.4479	308.5246	306.2935	295.2996	270.6229	240.7104	179.5700	114.2489	81.6294	(83)
Total gains	502.1607	567.4325	615.0175	644.5176	655.2681	632.4907	609.1562	587.1697	568.8063	528.5462	488.8501	478.6185	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	118.7730	119.3519	119.9364	122.9471	123.5675	126.7657	126.7657	127.4253	125.4668	123.5675	122.3329	121.1228	
alpha	8.9182	8.9568	8.9958	9.1965	9.2378	9.4510	9.4510	9.4950	9.3645	9.2378	9.1555	9.0749	
util living area	0.7139	0.6132	0.5090	0.3958	0.2977	0.2069	0.1477	0.1594	0.2506	0.4127	0.6002	0.7365	(86)
MIT	20.9808	20.9943	20.9989	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9999	20.9963	20.9773	(87)
Th 2	20.5442	20.5463	20.5484	20.5590	20.5612	20.5718	20.5718	20.5740	20.5676	20.5612	20.5569	20.5527	(88)
util rest of house	0.6964	0.5965	0.4933	0.3814	0.2837	0.1931	0.1333	0.1446	0.2349	0.3953	0.5816	0.7193	(89)
MIT 2	20.5244	20.5406	20.5473	20.5590	20.5612	20.5718	20.5718	20.5740	20.5676	20.5611	20.5534	20.5290	(90)
Living area fraction									fLA = Living area / (4) =			0.5849	(91)
MIT	20.7914	20.8060	20.8114	20.8169	20.8178	20.8223	20.8223	20.8232	20.8205	20.8177	20.8125	20.7912	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7914	20.8060	20.8114	20.8169	20.8178	20.8223	20.8223	20.8232	20.8205	20.8177	20.8125	20.7912	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7060	0.6060	0.5024	0.3898	0.2919	0.2012	0.1417	0.1533	0.2441	0.4055	0.5923	0.7285	(94)
Useful gains	354.5074	343.8804	309.0123	251.2398	191.2823	127.2439	86.3444	89.9842	138.8553	214.3281	289.5660	348.6732	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	359.9391	345.4791	309.3302	251.2663	191.2838	127.2440	86.3444	89.9842	138.8555	214.3586	290.5780	355.0941	(97)
Space heating kWh	4.0412	1.0743	0.2365	0.0191	0.0012	0.0000	0.0000	0.0000	0.0000	0.0227	0.7287	4.7771	(98a)
Space heating requirement - total per year (kWh/year)												10.9008	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	4.0412	1.0743	0.2365	0.0191	0.0012	0.0000	0.0000	0.0000	0.0000	0.0227	0.7287	4.7771	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												10.9008	
Space heating per m2										(98c) / (4) =		0.2370	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	4.0412	1.0743	0.2365	0.0191	0.0012	0.0000	0.0000	0.0000	0.0000	0.0227	0.7287	4.7771	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	4.0412	1.0743	0.2365	0.0191	0.0012	0.0000	0.0000	0.0000	0.0000	0.0227	0.7287	4.7771	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.0057	7.2310	8.0057	7.7475	8.0057	7.7475	8.0057	8.0057	7.7475	8.0057	7.7475	8.0057	(231)
Lighting	14.0284	11.2541	10.1331	7.4239	5.7345	4.6851	5.2312	6.7997	8.8321	11.5882	13.0888	14.4183	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.7161	-26.1824	-42.0244	-52.2243	-60.7154	-58.1899	-57.2669	-52.1119	-43.0571	-31.9504	-19.2097	-14.1333	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-4.2226	-9.7128	-21.2318	-34.9585	-48.5839	-49.7975	-49.0791	-39.8374	-27.3480	-14.5542	-5.8247	-3.2497	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												10.9008	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2113.5187	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	94.2611	(230a)
Total electricity for the above, kWh/year	94.2611	(231)
Electricity for lighting (calculated in Appendix L)	113.2174	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-782.1819	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1549.7161	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	10.9008	16.4900	1.7975	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2113.5187	16.4900	348.5192	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	94.2611	16.4900	15.5437	(249)
Energy for lighting	113.2174	16.4900	18.6696	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-473.7818	16.4900	-78.1266	
PV Unit electricity exported	-308.4001	5.5900	-17.2396	
Total			-95.3662	(252)
Total energy cost			289.1638	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1441	(257)
SAP value		81.4546	
SAP rating (Section 12)		81	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	10.9008	0.1616	1.7615	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2113.5187	0.1412	298.5203	(264)
Space and water heating			300.2818	(265)
Pumps, fans and electric keep-hot	94.2611	0.1387	13.0752	(267)
Energy for lighting	113.2174	0.1443	16.3408	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-473.7818	0.1326	-62.8047	
PV Unit electricity exported	-308.4001	0.1237	-38.1446	
Total			-100.9493	(269)
Total CO2, kg/year			228.7484	(272)
CO2 emissions per m2			4.9700	(273)
EI value			96.6312	
EI rating			97	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		45.9900 (1b)	x	2.4000 (2b)	=	110.3760	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.9900						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	110.3760	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.1800	1.2357	8.8726			(27)
External Wall 1	16.0600	7.1800	8.8800	0.1400	1.2432	14.0000	124.3200	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	10.1158			(33)
Party Wall 1			23.2200	0.0000	0.0000	20.0000	464.4000	(32)
Wall to corridor			39.2800	0.0000	0.0000	20.0000	785.6000	(32)
Party Floor 1			45.9900			80.0000	3679.2000	(32d)
Party Ceiling 1			45.9900			80.0000	3679.2000	(32b)
Internal Wall 1			66.6300			9.0000	599.6700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 9332.3900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	202.9222 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165
E18 Party wall between dwellings	2.7000	0.0600	0.1620
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	1.2120 (36)
Point Thermal bridges	(36a) = 0.0000
Total fabric heat loss	(33) + (36) + (36a) = 11.3278 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	10.6040	10.6040	10.3922	9.7571	9.6512	9.2278	9.0161	9.0161	9.4395	9.9688	10.1805	10.0747	(38)
Heat transfer coeff	21.9318	21.9318	21.7201	21.0849	20.9791	20.5556	20.3439	20.3439	20.7674	21.2966	21.5084	21.4025	(39)
Average = Sum(39)m / 12 =												21.1555	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4769	0.4769	0.4723	0.4585	0.4562	0.4470	0.4424	0.4424	0.4516	0.4631	0.4677	0.4654	(40)
HLP (average)												0.4600	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.5731 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	69.5673	68.5219	66.9984	64.0836	61.9325	59.5337	58.1702	59.6821	61.3394	63.9151	66.8925	69.3008	(42a)
Hot water usage for baths	21.8805	21.5555	21.0979	20.2542	19.6224	18.9219	18.5435	18.9979	19.4926	20.2422	21.1034	21.8065	(42b)
Hot water usage for other uses	30.7397	29.6219	28.5041	27.3863	26.2684	25.1506	25.1506	26.2684	27.3863	28.5041	29.6219	30.7397	(42c)
Average daily hot water use (litres/day)												112.3706	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	122.1875	119.6993	116.6004	111.7240	107.8234	103.6062	101.8643	104.9484	108.2183	112.6614	117.6177	121.8470	(44)
Energy conte	193.5151	170.4502	179.2105	152.9446	145.1510	127.3959	123.1960	129.9480	133.4440	152.8804	167.5680	190.7830	(45)
Energy content (annual)											Total = Sum(45)m =	1866.4867	
Distribution loss (46)m = 0.15 x (45)m	29.0273	25.5675	26.8816	22.9417	21.7726	19.1094	18.4794	19.4922	20.0166	22.9321	25.1352	28.6174	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(64)
									Total per year (kWh/year) = Sum(64)m =			2113.5187	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	81.1284	71.8350	76.3721	67.0973	65.0473	58.6023	57.7473	59.9924	60.6133	67.6174	71.9596	80.2200	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.0271	14.2351	11.5768	8.7644	6.5515	5.5310	5.9765	7.7684	10.4268	13.2392	15.4521	16.4725	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	204.2328	206.3521	201.0115	189.6421	175.2902	161.8015	152.7902	150.6709	156.0115	167.3809	181.7328	195.2215	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	(71)
Water heating gains (Table 5)	109.0436	106.8973	102.6507	93.1907	87.4292	81.3921	77.6173	80.6349	84.1852	90.8836	99.9438	107.8225	(72)
Total internal gains	406.7760	404.9571	392.7115	369.0697	346.7435	326.1972	313.8566	316.5468	328.0960	348.9762	374.6012	396.9891	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.1800	33.4622	0.6300	0.8270	0.7700	86.7478	(79)

Solar gains	86.7478	157.7089	225.5139	293.9220	325.8839	314.4382	306.9161	273.5144	241.9971	173.2574	106.7816	75.9203	(83)
Total gains	493.5238	562.6659	618.2254	662.9917	672.6273	640.6354	620.7726	590.0612	570.0931	522.2336	481.3828	472.9094	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	118.1997	118.1997	119.3519	122.9471	123.5675	126.1129	127.4253	127.4253	124.8272	121.7249	120.5267	121.1228	
alpha	8.8800	8.8800	8.9568	9.1965	9.2378	9.4075	9.4950	9.4950	9.3218	9.1150	9.0351	9.0749	
util living area	0.7428	0.6458	0.5400	0.4165	0.3212	0.2503	0.1999	0.2138	0.2987	0.4606	0.6391	0.7628	(86)
MIT	20.9731	20.9908	20.9980	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9996	20.9933	20.9694	(87)
Th 2	20.5421	20.5421	20.5463	20.5590	20.5612	20.5697	20.5740	20.5740	20.5654	20.5548	20.5506	20.5527	(88)
util rest of house	0.7256	0.6290	0.5243	0.4025	0.3076	0.2365	0.1859	0.1991	0.2829	0.4425	0.6200	0.7461	(89)
MIT 2	20.5139	20.5327	20.5443	20.5589	20.5612	20.5697	20.5740	20.5740	20.5654	20.5545	20.5440	20.5204	(90)
Living area fraction										fLA = Living area / (4) =		0.5849	(91)
MIT	20.7824	20.8007	20.8097	20.8168	20.8178	20.8214	20.8232	20.8232	20.8196	20.8149	20.8068	20.7830	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7824	20.8007	20.8097	20.8168	20.8178	20.8214	20.8232	20.8232	20.8196	20.8149	20.8068	20.7830	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7347	0.6386	0.5335	0.4107	0.3156	0.2445	0.1941	0.2077	0.2921	0.4531	0.6309	0.7548	(94)
Useful gains	362.6064	359.2916	329.7927	272.3050	212.2593	156.6621	120.5001	122.5345	166.5448	236.6137	303.7082	356.9401	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	370.2621	361.8891	330.3553	272.3499	212.2627	156.6623	120.5001	122.5345	166.5461	236.7092	305.5653	365.6195	(97)
Space heating kWh	5.6959	1.7455	0.4185	0.0323	0.0025	0.0000	0.0000	0.0000	0.0000	0.0710	1.3371	6.4575	(98a)
Space heating requirement - total per year (kWh/year)												15.7604	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	5.6959	1.7455	0.4185	0.0323	0.0025	0.0000	0.0000	0.0000	0.0000	0.0710	1.3371	6.4575	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												15.7604	
Space heating per m2											(98c) / (4) =	0.3427	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	5.6959	1.7455	0.4185	0.0323	0.0025	0.0000	0.0000	0.0000	0.0000	0.0710	1.3371	6.4575	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													

	5.6959	1.7455	0.4185	0.0323	0.0025	0.0000	0.0000	0.0000	0.0000	0.0710	1.3371	6.4575 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	8.0057	7.2310	8.0057	7.7475	8.0057	7.7475	8.0057	8.0057	7.7475	8.0057	7.7475	8.0057 (231)
Lighting	14.0284	11.2541	10.1331	7.4239	5.7345	4.6851	5.2312	6.7997	8.8321	11.5882	13.0888	14.4183 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-15.1735	-25.2163	-42.0172	-54.3084	-62.7136	-58.9778	-58.5016	-52.1268	-42.7872	-30.6548	-17.8872	-13.0808 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-3.5931	-9.0969	-21.2173	-37.6435	-51.7907	-51.1590	-51.2273	-39.8596	-27.0295	-13.5333	-5.1652	-2.8571 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	15.7604 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2113.5187 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	94.2611 (230a)
Total electricity for the above, kWh/year	94.2611 (231)
Electricity for lighting (calculated in Appendix L)	113.2174 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-787.6175 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1549.1401 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	15.7604	25.1600	3.9653	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2113.5187	25.1600	531.7613	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	94.2611	25.1600	23.7161	(249)
Energy for lighting	113.2174	25.1600	28.4855	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-473.4451	25.1600	-119.1188	
PV Unit electricity exported	-314.1723	5.8100	-18.2534	
Total			-137.3722	(252)
Total energy cost			450.5560	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	15.7604	0.1612	2.5408	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2113.5187	0.1412	298.5203	(264)
Space and water heating			301.0612	(265)
Pumps, fans and electric keep-hot	94.2611	0.1387	13.0752	(267)
Energy for lighting	113.2174	0.1443	16.3408	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-473.4451	0.1322	-62.6123	
PV Unit electricity exported	-314.1723	0.1232	-38.7054	
Total			-101.3177	(269)
Total CO2, kg/year			229.1594	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	15.7604	1.5966	25.1627	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2113.5187	1.5223	3217.3749	(278)
Space and water heating			3242.5376	(279)

Pumps, fans and electric keep-hot	94.2611	1.5128	142.5982 (281)
Energy for lighting	113.2174	1.5338	173.6566 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-473.4451	1.4886	-704.7902
PV Unit electricity exported	-314.1723	0.4521	-142.0521
Total			-846.8422 (283)
Total Primary energy kWh/year			2711.9503 (286)

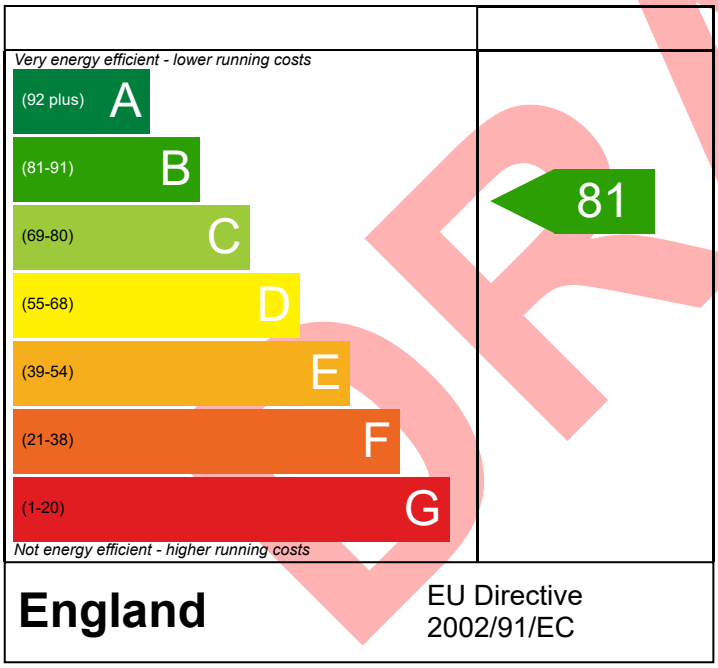
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	45.99 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

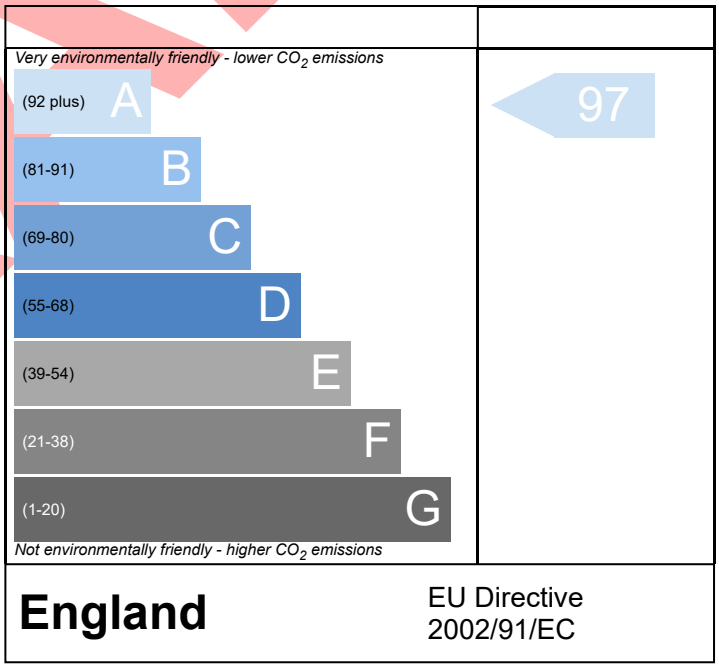
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:20

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	71 m^2
Site Reference	Unit 401 L03_Copy	Plot Reference	Unit 401 L03_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*9.51 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	4.43 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*51.39 kWh$_{PE}$/m^2*	
Dwelling primary energy	50.5 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*14.0 kWh/m^2*	
Dwelling fabric energy efficiency	12.9 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	11	0.14 **(!)**
Party wall: Party Wall (1)	52.62	0 **(!)**
Party wall: Party Wall (2)	15.55	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	11.81	South West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation

Technology type: **Photovoltaic system (1)**	
Peak power	0.92 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks

N/A

11 Supporting documentary evidence

N/A

12 Declarations

a. Assessor Declaration

This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.

Signed:	Assessor ID:
Name:	Date:

b. Client Declaration

N/A

Full SAP Calculation Printout

Property Reference	Unit 401 L03_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 401 L03_Copy	**Prop Type Ref**	Unit 401 L03
Property			

SAP Rating	81 B	**DER**	4.43	**TER**	9.51
Environmental	96 A	**% DER < TER**			53.42
CO_2 Emissions (t/year)	0.31	**DFEE**	12.95	**TFEE**	14.02
Compliance Check	See BREL	**% DFEE < TFEE**			7.68
% DPER < TPER	1.73	**DPER**	50.50	**TPER**	51.39

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			136.8900			9.0000	1232.0100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 14106.2100	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.7350	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545

E4 Jamb	13.9200	0.0500	0.6960	
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.8660 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.2026	16.0392	15.8758	15.0589	14.8955	14.0786	14.0786	13.9153	14.4054	14.8955	15.2223	15.5490	(38)
Heat transfer coeff	34.2027	34.0393	33.8759	33.0590	32.8956	32.0787	32.0787	31.9154	32.4055	32.8956	33.2224	33.5491	(39)

Average = Sum(39)m / 12 = 33.0182

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4819	0.4796	0.4773	0.4658	0.4634	0.4519	0.4519	0.4496	0.4565	0.4634	0.4681	0.4727	(40)
HLP (average)												0.4652	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2697 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day) 138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)

Energy content (annual) Total = Sum(45)m = 2297.5146

Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)

Total per year (kWh/year) = Sum(64)m = 2544.5466 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	11.8100	36.7938	0.6300	0.8270	0.7700	156.8932	(79)

Solar gains	156.8932	267.2472	365.6593	453.0696	507.4757	503.8059	485.7227	445.1333	395.9317	295.3651	187.9219	134.2679	(83)
Total gains	703.2397	811.4507	893.0014	948.1177	971.2994	939.0493	903.8213	866.4472	833.2498	761.5780	689.4197	666.6128	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.5640	115.1138	115.6690	118.5272	119.1159	122.1492	122.1492	122.7745	120.9175	119.1159	117.9443	116.7956	
alpha	8.6376	8.6743	8.7113	8.9018	8.9411	9.1433	9.1433	9.1850	9.0612	8.9411	8.8630	8.7864	
util living area													
	0.7830	0.6679	0.5487	0.4218	0.3150	0.2186	0.1562	0.1694	0.2683	0.4490	0.6634	0.8084	(86)
MIT	20.9566	20.9872	20.9974	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9997	20.9906	20.9478	(87)
Th 2	20.5375	20.5396	20.5417	20.5523	20.5544	20.5651	20.5651	20.5672	20.5608	20.5544	20.5502	20.5460	(88)
util rest of house													
	0.7656	0.6501	0.5316	0.4062	0.2999	0.2038	0.1407	0.1535	0.2513	0.4298	0.6432	0.7918	(89)
MIT 2	20.4917	20.5266	20.5392	20.5521	20.5544	20.5651	20.5651	20.5672	20.5608	20.5542	20.5409	20.4903	(90)
Living area fraction										fLA = Living area / (4) =		0.4060	(91)
MIT	20.6805	20.7136	20.7253	20.7339	20.7353	20.7417	20.7417	20.7429	20.7391	20.7351	20.7235	20.6760	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6805	20.7136	20.7253	20.7339	20.7353	20.7417	20.7417	20.7429	20.7391	20.7351	20.7235	20.6760	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7711	0.6569	0.5385	0.4125	0.3060	0.2098	0.1470	0.1600	0.2582	0.4376	0.6510	0.7967	(94)
Useful gains	542.2498	533.0331	480.8626	391.1295	297.2181	197.0170	132.8596	138.6063	215.1439	333.2833	448.8144	531.0779	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	560.2549	538.2843	481.8939	391.2164	297.2233	197.0171	132.8596	138.6064	215.1447	333.3996	452.6050	552.7564	(97)
Space heating kWh													
	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(98a)
Space heating requirement - total per year (kWh/year)												36.7029	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												36.7029	
Space heating per m2											(98c) / (4) =	0.5171	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)
Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.7495	-26.5603	-43.1928	-54.4883	-64.0200	-61.6099	-60.6290	-54.7463	-44.7493	-32.6607	-19.3354	-14.1254	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.5280	-8.2015	-18.0659	-29.9413	-41.8277	-42.9674	-42.3587	-34.2994	-23.4325	-12.3753	-4.9084	-2.7087	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	36.7029	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2544.5466	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	154.2094	(230a)
Total electricity for the above, kWh/year	154.2094	(231)
Electricity for lighting (calculated in Appendix L)	163.7369	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-757.4814	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2141.7144	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	36.7029	16.4900	6.0523	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	16.4900	419.5957	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	16.4900	25.4291	(249)
Energy for lighting	163.7369	16.4900	27.0002	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-492.8668	16.4900	-81.2737	
PV Unit electricity exported	-264.6146	5.5900	-14.7920	
Total			-96.0657	(252)
Total energy cost			382.0117	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1858	(257)
SAP value		80.7789	
SAP rating (Section 12)		81	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	36.7029	0.1615	5.9279	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			365.4724	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-492.8668	0.1323	-65.2087	
PV Unit electricity exported	-264.6146	0.1235	-32.6780	
Total			-97.8867	(269)
Total CO2, kg/year			312.6088	(272)
CO2 emissions per m2			4.4000	(273)
EI value			96.3882	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			136.8900			9.0000	1232.0100	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14106.2100 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 198.7350 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.8660 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3659	16.3659	16.0392	15.0589	14.8955	14.2420	13.9153	13.9153	14.5688	15.3857	15.7124	15.5490	(38)
Heat transfer coeff	34.3660	34.3660	34.0393	33.0590	32.8956	32.2421	31.9154	31.9154	32.5689	33.3858	33.7125	33.5491	(39)

Average = Sum(39)m / 12 = 33.1679

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4842	0.4842	0.4796	0.4658	0.4634	0.4542	0.4496	0.4496	0.4588	0.4704	0.4750	0.4727	(40)
HLP (average)												0.4673	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2697 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day) 138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:

Store volume 143.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)

Temperature factor from Table 2b 0.6000 (49)

Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
										Total per year (kWh/year) = Sum(64)m =		2544.5466	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)													
	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains													
	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	11.8100	33.4622	0.6300	0.8270	0.7700	142.6869	(79)

Solar gains	142.6869	259.4069	370.9357	483.4567	536.0291	517.2027	504.8299	449.8893	398.0481	284.9819	175.6394	124.8772	(83)
Total gains	689.0334	803.6104	898.2779	978.5047	999.8527	952.4462	922.9286	871.2033	835.3662	751.1948	677.1372	657.2222	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.0193	114.0193	115.1138	118.5272	119.1159	121.5302	122.7745	122.7745	120.3109	117.3671	116.2296	116.7956	
alpha	8.6013	8.6013	8.6743	8.9018	8.9411	9.1020	9.1850	9.1850	9.0207	8.8245	8.7486	8.7864	
util living area													
	0.8121	0.7024	0.5813	0.4424	0.3389	0.2640	0.2109	0.2271	0.3197	0.5016	0.7054	0.8339	(86)
MIT	20.9408	20.9801	20.9957	20.9996	21.0000	21.0000	21.0000	21.0000	21.0000	20.9991	20.9836	20.9316	(87)
Th 2	20.5354	20.5354	20.5396	20.5523	20.5544	20.5630	20.5672	20.5672	20.5587	20.5481	20.5438	20.5460	(88)
util rest of house													
	0.7957	0.6848	0.5643	0.4273	0.3242	0.2492	0.1960	0.2113	0.3025	0.4817	0.6853	0.8185	(89)
MIT 2	20.4720	20.5147	20.5353	20.5520	20.5544	20.5630	20.5672	20.5672	20.5587	20.5473	20.5274	20.4721	(90)
Living area fraction										fLA = Living area / (4) =		0.4060	(91)
MIT	20.6623	20.7037	20.7222	20.7337	20.7353	20.7404	20.7429	20.7429	20.7379	20.7307	20.7126	20.6587	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6623	20.7037	20.7222	20.7337	20.7353	20.7404	20.7429	20.7429	20.7379	20.7307	20.7126	20.6587	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8002	0.6912	0.5711	0.4334	0.3302	0.2553	0.2021	0.2177	0.3095	0.4898	0.6928	0.8224	(94)
Useful gains	551.3951	555.4826	512.9858	424.1297	330.1075	243.1179	186.4793	189.6708	258.5229	367.9207	469.1053	540.4930	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	576.0546	563.7301	514.7494	424.2710	330.1185	243.1186	186.4794	189.6709	258.5275	368.2690	475.7715	568.9488	(97)
Space heating kWh													
	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711	(98a)
Space heating requirement - total per year (kWh/year)												51.5410	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												51.5410	
Space heating per m2											(98c) / (4) =	0.7261	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)

Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-15.1816	-25.5601	-43.1889	-56.7799	-66.2625	-62.5005	-62.0252	-54.7629	-44.4553	-31.2938	-17.9805	-13.0606 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.9923	-7.6695	-18.0487	-32.2682	-44.6258	-44.1582	-44.2385	-34.3187	-23.1566	-11.4989	-4.3440	-2.3741 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	51.5410 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2544.5466 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	154.2094 (230a)
Total electricity for the above, kWh/year	154.2094 (231)
Electricity for lighting (calculated in Appendix L)	163.7369 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-762.7453 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2151.2886 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	51.5410	25.1600	12.9677	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	25.1600	640.2079	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	25.1600	38.7991	(249)
Energy for lighting	163.7369	25.1600	41.1962	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.0518	25.1600	-124.0518	
PV Unit electricity exported	-269.6935	5.8100	-15.6692	
Total			-139.7210	(252)
Total energy cost			593.4499	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	51.5410	0.1611	8.3045	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			367.8491	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.0518	0.1320	-65.0800	
PV Unit electricity exported	-269.6935	0.1230	-33.1742	
Total			-98.2543	(269)
Total CO2, kg/year			314.6179	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	51.5410	1.5962	82.2716	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	1.5225	3874.0629	(278)
Space and water heating			3956.3345	(279)
Pumps, fans and electric keep-hot	154.2094	1.5128	233.2880	(281)
Energy for lighting	163.7369	1.5338	251.1452	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.0518	1.4877	-733.5071	
PV Unit electricity exported	-269.6935	0.4514	-121.7494	
Total			-855.2565	(283)
Total Primary energy kWh/year			3585.5112	(286)

SAP 10 EPC IMPROVEMENTS

Unit 401 L03_Copy

Current energy efficiency rating: B 81
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: B 81
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£733	£733	£0
Space heating	£52	£52	£0
Water heating	£640	£640	£0
Lighting	£41	£41	£0
Generated (PV)	-£140	-£140	£0
Total cost of fuels	£593	£593	£0
Total cost of uses	£593	£593	£0
Delivered energy	30 kWh/m²	30 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	4 kg/m²	4 kg/m²	0 kg/m²
Primary energy	51 kWh/m²	51 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			136.8900			9.0000	1232.0100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14106.2100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		198.7350 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.8660 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.2026	16.0392	15.8758	15.0589	14.8955	14.0786	14.0786	13.9153	14.4054	14.8955	15.2223	15.5490	(38)
Heat transfer coeff	34.2027	34.0393	33.8759	33.0590	32.8956	32.0787	32.0787	31.9154	32.4055	32.8956	33.2224	33.5491	(39)
Average = Sum(39)m / 12 =												33.0182	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4819	0.4796	0.4773	0.4658	0.4634	0.4519	0.4519	0.4496	0.4565	0.4634	0.4681	0.4727	(40)
HLP (average)												0.4652	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.2697 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)

Hot water usage for baths

26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)

Hot water usage for other uses

37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day)		138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
									Total per year (kWh/year) = Sum(64)m =		2544.5466	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest			11.8100	36.7938	0.6300	0.8270	0.7700	156.8932	(79)
Solar gains	156.8932	267.2472	365.6593	453.0696	507.4757	503.8059	485.7227	445.1333	395.9317	295.3651	187.9219	134.2679	(83)
Total gains	703.2397	811.4507	893.0014	948.1177	971.2994	939.0493	903.8213	866.4472	833.2498	761.5780	689.4197	666.6128	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.5640	115.1138	115.6690	118.5272	119.1159	122.1492	122.1492	122.7745	120.9175	119.1159	117.9443	116.7956	
alpha	8.6376	8.6743	8.7113	8.9018	8.9411	9.1433	9.1433	9.1850	9.0612	8.9411	8.8630	8.7864	
util living area	0.7830	0.6679	0.5487	0.4218	0.3150	0.2186	0.1562	0.1694	0.2683	0.4490	0.6634	0.8084	(86)
MIT	20.9566	20.9872	20.9974	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9997	20.9906	20.9478	(87)
Th 2	20.5375	20.5396	20.5417	20.5523	20.5544	20.5651	20.5651	20.5672	20.5608	20.5544	20.5502	20.5460	(88)
util rest of house	0.7656	0.6501	0.5316	0.4062	0.2999	0.2038	0.1407	0.1535	0.2513	0.4298	0.6432	0.7918	(89)
MIT 2	20.4917	20.5266	20.5392	20.5521	20.5544	20.5651	20.5651	20.5672	20.5608	20.5542	20.5409	20.4903	(90)
Living area fraction									fLA = Living area / (4) =			0.4060	(91)
MIT	20.6805	20.7136	20.7253	20.7339	20.7353	20.7417	20.7417	20.7429	20.7391	20.7351	20.7235	20.6760	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6805	20.7136	20.7253	20.7339	20.7353	20.7417	20.7417	20.7429	20.7391	20.7351	20.7235	20.6760	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7711	0.6569	0.5385	0.4125	0.3060	0.2098	0.1470	0.1600	0.2582	0.4376	0.6510	0.7967	(94)
Useful gains	542.2498	533.0331	480.8626	391.1295	297.2181	197.0170	132.8596	138.6063	215.1439	333.2833	448.8144	531.0779	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	560.2549	538.2843	481.8939	391.2164	297.2233	197.0171	132.8596	138.6064	215.1447	333.3996	452.6050	552.7564	(97)
Space heating kWh	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(98a)
Space heating requirement - total per year (kWh/year)												36.7029	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												36.7029	
Space heating per m2										(98c) / (4) =		0.5171	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)
Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.7495	-26.5603	-43.1928	-54.4883	-64.0200	-61.6099	-60.6290	-54.7463	-44.7493	-32.6607	-19.3354	-14.1254	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.5280	-8.2015	-18.0659	-29.9413	-41.8277	-42.9674	-42.3587	-34.2994	-23.4325	-12.3753	-4.9084	-2.7087	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												36.7029	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2544.5466	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	154.2094	(230a)
Total electricity for the above, kWh/year	154.2094	(231)
Electricity for lighting (calculated in Appendix L)	163.7369	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-757.4814	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2141.7144	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	36.7029	16.4900	6.0523	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	16.4900	419.5957	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	16.4900	25.4291	(249)
Energy for lighting	163.7369	16.4900	27.0002	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-492.8668	16.4900	-81.2737	
PV Unit electricity exported	-264.6146	5.5900	-14.7920	
Total			-96.0657	(252)
Total energy cost			382.0117	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.1858	(257)
SAP value	80.7789	
SAP rating (Section 12)	81	(258)
SAP band	B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	36.7029	0.1615	5.9279	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			365.4724	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-492.8668	0.1323	-65.2087	
PV Unit electricity exported	-264.6146	0.1235	-32.6780	
Total			-97.8867	(269)
Total CO2, kg/year			312.6088	(272)
CO2 emissions per m2			4.4000	(273)
EI value			96.3882	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 = 0.0000	(6a)
Number of open flues	0 * 20 = 0.0000	(6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			136.8900			9.0000	1232.0100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 14106.2100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.7350 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	1.8660 (36)
Point Thermal bridges (36a) =	0.0000
Total fabric heat loss (33) + (36) + (36a) =	18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3659	16.3659	16.0392	15.0589	14.8955	14.2420	13.9153	13.9153	14.5688	15.3857	15.7124	15.5490	(38)
Heat transfer coeff	34.3660	34.3660	34.0393	33.0590	32.8956	32.2421	31.9154	31.9154	32.5689	33.3858	33.7125	33.5491	(39)
Average = Sum(39)m / 12 =												33.1679	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4842	0.4842	0.4796	0.4658	0.4634	0.4542	0.4496	0.4496	0.4588	0.4704	0.4750	0.4727	(40)
HLP (average)												0.4673	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2697 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)
Average daily hot water use (litres/day)												138.3203	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
									Total per year (kWh/year) = Sum(64)m =			2544.5466	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	11.8100	33.4622	0.6300	0.8270	0.7700	142.6869	(79)

Solar gains	142.6869	259.4069	370.9357	483.4567	536.0291	517.2027	504.8299	449.8893	398.0481	284.9819	175.6394	124.8772	(83)
Total gains	689.0334	803.6104	898.2779	978.5047	999.8527	952.4462	922.9286	871.2033	835.3662	751.1948	677.1372	657.2222	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.0193	114.0193	115.1138	118.5272	119.1159	121.5302	122.7745	122.7745	120.3109	117.3671	116.2296	116.7956	
alpha	8.6013	8.6013	8.6743	8.9018	8.9411	9.1020	9.1850	9.1850	9.0207	8.8245	8.7486	8.7864	
util living area	0.8121	0.7024	0.5813	0.4424	0.3389	0.2640	0.2109	0.2271	0.3197	0.5016	0.7054	0.8339	(86)
MIT	20.9408	20.9801	20.9957	20.9996	21.0000	21.0000	21.0000	21.0000	21.0000	20.9991	20.9836	20.9316	(87)
Th 2	20.5354	20.5354	20.5396	20.5523	20.5544	20.5630	20.5672	20.5672	20.5587	20.5481	20.5438	20.5460	(88)
util rest of house	0.7957	0.6848	0.5643	0.4273	0.3242	0.2492	0.1960	0.2113	0.3025	0.4817	0.6853	0.8185	(89)
MIT 2	20.4720	20.5147	20.5353	20.5520	20.5544	20.5630	20.5672	20.5672	20.5587	20.5473	20.5274	20.4721	(90)
Living area fraction									fLA = Living area / (4) =			0.4060	(91)
MIT	20.6623	20.7037	20.7222	20.7337	20.7353	20.7404	20.7429	20.7429	20.7379	20.7307	20.7126	20.6587	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6623	20.7037	20.7222	20.7337	20.7353	20.7404	20.7429	20.7429	20.7379	20.7307	20.7126	20.6587	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8002	0.6912	0.5711	0.4334	0.3302	0.2553	0.2021	0.2177	0.3095	0.4898	0.6928	0.8224	(94)
Useful gains	551.3951	555.4826	512.9858	424.1297	330.1075	243.1179	186.4793	189.6708	258.5229	367.9207	469.1053	540.4930	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	576.0546	563.7301	514.7494	424.2710	330.1185	243.1186	186.4794	189.6709	258.5275	368.2690	475.7715	568.9488	(97)
Space heating kWh	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711	(98a)
Space heating requirement - total per year (kWh/year)												51.5410	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												51.5410	
Space heating per m2											(98c) / (4) =	0.7261	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													

	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972 (231)
Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-15.1816	-25.5601	-43.1889	-56.7799	-66.2625	-62.5005	-62.0252	-54.7629	-44.4553	-31.2938	-17.9805	-13.0606 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.9923	-7.6695	-18.0487	-32.2682	-44.6258	-44.1582	-44.2385	-34.3187	-23.1566	-11.4989	-4.3440	-2.3741 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	51.5410 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2544.5466 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	154.2094 (230a)
Total electricity for the above, kWh/year	154.2094 (231)
Electricity for lighting (calculated in Appendix L)	163.7369 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-762.7453 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2151.2886 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	51.5410	25.1600	12.9677	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	25.1600	640.2079	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	25.1600	38.7991	(249)
Energy for lighting	163.7369	25.1600	41.1962	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.0518	25.1600	-124.0518	
PV Unit electricity exported	-269.6935	5.8100	-15.6692	
Total			-139.7210	(252)
Total energy cost			593.4499	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	51.5410	0.1611	8.3045	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			367.8491	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.0518	0.1320	-65.0800	
PV Unit electricity exported	-269.6935	0.1230	-33.1742	
Total			-98.2543	(269)
Total CO2, kg/year			314.6179	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	51.5410	1.5962	82.2716	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	1.5225	3874.0629	(278)
Space and water heating			3956.3345	(279)

Pumps, fans and electric keep-hot	154.2094	1.5128	233.2880	(281)
Energy for lighting	163.7369	1.5338	251.1452	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.0518	1.4877	-733.5071	
PV Unit electricity exported	-269.6935	0.4514	-121.7494	
Total			-855.2565	(283)
Total Primary energy kWh/year			3585.5112	(286)

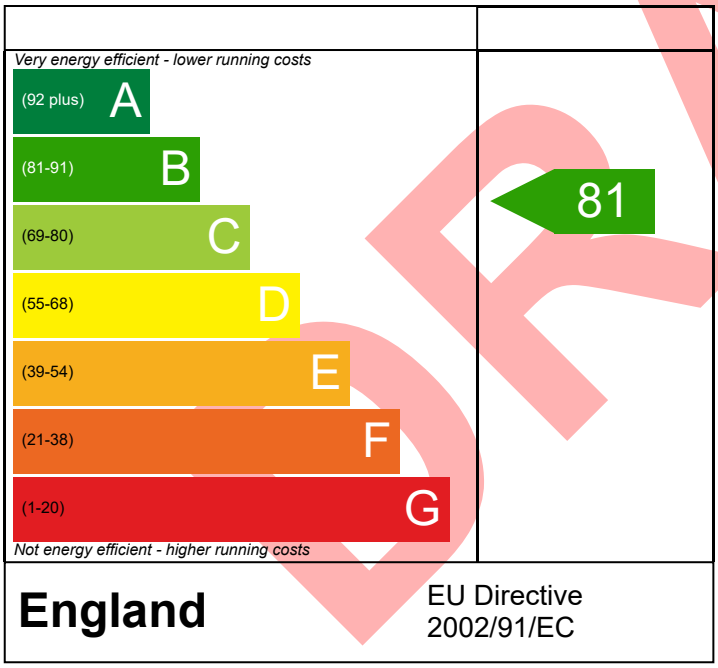
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	70.98 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

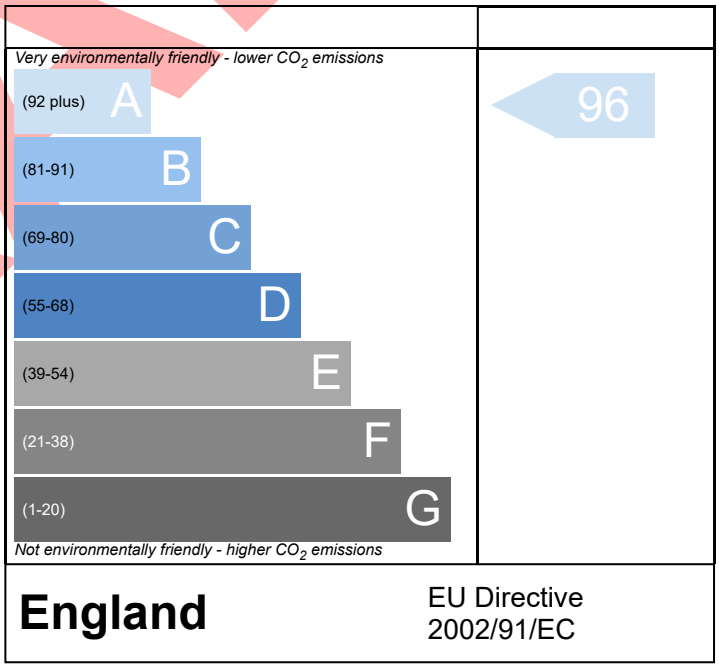
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:22

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	66 m^2
Site Reference	Unit 402 L03_Copy	Plot Reference	Unit 402 L03_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*10.63 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	5.05 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*57.39 kWh$_{PE}$/m^2*	
Dwelling primary energy	56.68 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*19.0 kWh/m^2*	
Dwelling fabric energy efficiency	18.9 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	24.21	0.14 **(!)**
Party wall: Party Wall (1)	55.93	0 **(!)**
Party wall: Party Wall (2)	3.85	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	7.88	South West	0.83	1.3
SE, Opening Type 1	11.81	South East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.86 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 402 L03_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 402 L03_Copy	**Prop Type Ref**	Unit 402 L03
Property			

SAP Rating	79 C	**DER**	5.05	**TER**	10.63
Environmental	96 A	**% DER < TER**			52.49
CO_2 Emissions (t/year)	0.34	**DFEE**	18.93	**TFEE**	19.00
Compliance Check	See BREL	**% DFEE < TFEE**			0.33
% DPER < TPER	1.24	**DPER**	56.68	**TPER**	57.39

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.5000 (1b)	x	2.4000 (2b)	=	159.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.6000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	43.9000	19.6900	24.2100	0.1400	3.3894	14.0000	338.9400	(29a)
Total net area of external elements Aum(A, m2)			43.9000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.7211			(33)
Party Wall 1			55.9300	0.0000	0.0000	20.0000	1118.6000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.5000			80.0000	5320.0000	(32d)
Party Ceiling 1			66.5000			80.0000	5320.0000	(32b)
Internal Wall 1			140.2900			9.0000	1262.6100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13437.1500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.0624 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240

E4 Jamb	23.2000	0.0500	1.1600	
E7 Party floor between dwellings (in blocks of flats)	16.1600	0.0700	1.1312	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	22.1400	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.0392 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 30.7603 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.9354	15.7675	15.5996	14.7602	14.5923	13.7529	13.7529	13.5851	14.0887	14.5923	14.9281	15.2638	(38)
Heat transfer coeff	46.6957	46.5278	46.3600	45.5206	45.3527	44.5133	44.5133	44.3454	44.8490	45.3527	45.6884	46.0242	(39)

Average = Sum(39)m / 12 = 45.4786

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7022	0.6997	0.6971	0.6845	0.6820	0.6694	0.6694	0.6668	0.6744	0.6820	0.6870	0.6921	(40)
HLP (average)												0.6839	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1583 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	83.0588	81.8106	79.9917	76.5116	73.9433	71.0793	69.4513	71.2564	73.2352	76.3103	79.8652	82.7406	(42a)
Hot water usage for baths	26.1000	25.7123	25.1665	24.1600	23.4064	22.5708	22.1194	22.6614	23.2516	24.1458	25.1729	26.0117	(42b)
Hot water usage for other uses	36.7327	35.3969	34.0612	32.7255	31.3897	30.0540	30.0540	31.3897	32.7255	34.0612	35.3969	36.7327	(42c)

Average daily hot water use (litres/day) 134.1695 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.8914	142.9198	139.2194	133.3971	128.7395	123.7040	121.6247	125.3076	129.2122	134.5173	140.4351	145.4849	(44)
Energy conte	231.0563	203.5159	213.9750	182.6139	173.3081	152.1085	147.0945	155.1570	159.3316	182.5387	200.0755	227.7943	(45)

Energy content (annual) Total = Sum(45)m = 2228.5693

Distribution loss (46)m = 0.15 x (45)m	34.6584	30.5274	32.0962	27.3921	25.9962	22.8163	22.0642	23.2735	23.8997	27.3808	30.0113	34.1691	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)

Total per year (kWh/year) = Sum(64)m = 2475.6013 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	93.6109	82.8294	87.9313	76.9623	74.4096	66.8193	65.6936	68.3743	69.2210	77.4788	82.7683	92.5262	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7552	19.3227	15.7143	11.8967	8.8930	7.5078	8.1125	10.5449	14.1533	17.9709	20.9747	22.3598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	282.0814	285.0085	277.6323	261.9291	242.1067	223.4764	211.0302	208.1031	215.4793	231.1825	251.0049	269.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	(71)
Water heating gains (Table 5)	125.8211	123.2580	118.1873	106.8921	100.0129	92.8046	88.2978	91.9010	96.1402	104.1381	114.9560	124.3632	(72)
Total internal gains	522.9304	520.8621	504.8066	473.9908	444.2853	417.0615	400.7133	403.8217	419.0457	446.5643	480.2084	509.6310	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	11.8100	36.7938	0.6300	0.8270	0.7700	156.8932	(77)
Southwest	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(79)

Solar gains	261.5773	445.5629	609.6386	755.3718	846.0793	839.9609	809.8120	742.1401	660.1097	492.4419	313.3093	223.8557	(83)
Total gains	784.5077	966.4250	1114.4452	1229.3625	1290.3646	1257.0225	1210.5252	1145.9618	1079.1553	939.0062	793.5177	733.4867	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	79.9333	80.2217	80.5122	81.9968	82.3004	83.8523	83.8523	84.1698	83.2246	82.3004	81.6955	81.0996	
alpha	6.3289	6.3481	6.3675	6.4665	6.4867	6.5902	6.5902	6.6113	6.5483	6.4867	6.4464	6.4066	
util living area	0.8610	0.7342	0.5934	0.4467	0.3267	0.2266	0.1618	0.1780	0.2867	0.4994	0.7534	0.8867	(86)
MIT	20.7806	20.9169	20.9770	20.9964	20.9996	21.0000	21.0000	21.0000	20.9999	20.9943	20.9214	20.7412	(87)
Th 2	20.3389	20.3411	20.3434	20.3545	20.3568	20.3680	20.3680	20.3702	20.3635	20.3568	20.3523	20.3478	(88)
util rest of house	0.8427	0.7107	0.5685	0.4232	0.3042	0.2042	0.1386	0.1536	0.2603	0.4693	0.7265	0.8706	(89)
MIT 2	20.1020	20.2557	20.3211	20.3513	20.3564	20.3679	20.3680	20.3702	20.3634	20.3519	20.2739	20.0650	(90)
Living area fraction									fLA = Living area / (4) =			0.3370	(91)
MIT	20.3307	20.4785	20.5421	20.5687	20.5732	20.5809	20.5810	20.5824	20.5779	20.5684	20.4921	20.2928	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3307	20.4785	20.5421	20.5687	20.5732	20.5809	20.5810	20.5824	20.5779	20.5684	20.4921	20.2928	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8425	0.7157	0.5761	0.4310	0.3118	0.2118	0.1464	0.1618	0.2692	0.4793	0.7325	0.8692	(94)
Useful gains	660.9362	691.6463	641.9935	529.8378	402.2774	266.2236	177.2049	185.4711	290.4875	450.0389	581.2287	637.5157	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	748.5635	724.8350	650.9921	531.1672	402.4220	266.2311	177.2054	185.4720	290.5269	452.0934	611.8637	740.6597	(97)
Space heating kWh	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(98a)
Space heating requirement - total per year (kWh/year)												195.5822	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												195.5822	
Space heating per m2											(98c) / (4) =	2.9411	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 100.0000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5760	10.4558	11.5760	11.2026	11.5760	11.2026	11.5760	11.5760	11.2026	11.5760	11.2026	11.5760	(231)
Lighting	19.0422	15.2763	13.7546	10.0772	7.7840	6.3596	7.1008	9.2299	11.9887	15.7298	17.7668	19.5714	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.8374	-25.0495	-40.6440	-51.2425	-60.2341	-57.9825	-57.0592	-51.4970	-42.0573	-30.6737	-18.2140	-13.3632	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.1177	-7.4452	-16.6195	-27.6808	-38.7105	-39.7745	-39.2119	-31.7414	-21.6778	-11.4252	-4.4487	-2.3730	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year
Space heating fuel - main system 1 195.5822 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 100.0000
Water heating fuel used 2475.6013 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)
mechanical ventilation fans (SFP = 0.7000) 136.2984 (230a)
Total electricity for the above, kWh/year 136.2984 (231)
Electricity for lighting (calculated in Appendix L) 153.6812 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation -708.0805 (233)
Wind generation 0.0000 (234)
Hydro-electric generation (Appendix N) 0.0000 (235a)
Electricity generated - Micro CHP (Appendix N) 0.0000 (235)

Appendix Q - special features

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2253.0826	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	195.5822	16.4900	32.2515	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	16.4900	408.2267	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	136.2984	16.4900	22.4756	(249)
Energy for lighting	153.6812	16.4900	25.3420	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-463.8543	16.4900	-76.4896	
PV Unit electricity exported	-244.2261	5.5900	-13.6522	
Total			-90.1418	(252)
Total energy cost			398.1540	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2855	(257)
SAP value	79.1617	
SAP rating (Section 12)	79	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	195.5822	0.1606	31.4176	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2475.6013	0.1413	349.7834	(264)
Space and water heating			381.2010	(265)
Pumps, fans and electric keep-hot	136.2984	0.1387	18.9063	(267)
Energy for lighting	153.6812	0.1443	22.1809	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-463.8543	0.1323	-61.3768	
PV Unit electricity exported	-244.2261	0.1233	-30.1190	
Total			-91.4957	(269)
Total CO2, kg/year			330.7925	(272)
CO2 emissions per m2			4.9700	(273)
EI value			96.0246	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		66.5000 (1b)	x	2.4000 (2b)	=	159.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.5000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.6000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	43.9000	19.6900	24.2100	0.1400	3.3894	14.0000	338.9400	(29a)
Total net area of external elements Aum(A, m2)			43.9000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.7211			(33)
Party Wall 1			55.9300	0.0000	0.0000	20.0000	1118.6000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.5000			80.0000	5320.0000	(32d)
Party Ceiling 1			66.5000			80.0000	5320.0000	(32b)
Internal Wall 1			140.2900			9.0000	1262.6100	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13437.1500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 202.0624 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.1600	0.0700	1.1312
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	22.1400	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.0392 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 30.7603 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.1032	16.1032	15.7675	14.7602	14.5923	13.9208	13.5851	13.5851	14.2566	15.0960	15.4317	15.2638	(38)
Heat transfer coeff	46.8636	46.8636	46.5278	45.5206	45.3527	44.6812	44.3454	44.3454	45.0169	45.8563	46.1921	46.0242	(39)
Average = Sum(39)m / 12 =												45.6325	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7047	0.7047	0.6997	0.6845	0.6820	0.6719	0.6668	0.6668	0.6769	0.6896	0.6946	0.6921	(40)
HLP (average)												0.6862	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1583 (42)
Hot water usage for mixer showers

83.0588	81.8106	79.9917	76.5116	73.9433	71.0793	69.4513	71.2564	73.2352	76.3103	79.8652	82.7406	(42a)

Hot water usage for baths

26.1000	25.7123	25.1665	24.1600	23.4064	22.5708	22.1194	22.6614	23.2516	24.1458	25.1729	26.0117	(42b)

Hot water usage for other uses

36.7327	35.3969	34.0612	32.7255	31.3897	30.0540	30.0540	31.3897	32.7255	34.0612	35.3969	36.7327	(42c)

Average daily hot water use (litres/day) 134.1695 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.8914	142.9198	139.2194	133.3971	128.7395	123.7040	121.6247	125.3076	129.2122	134.5173	140.4351	145.4849	(44)
Energy conte	231.0563	203.5159	213.9750	182.6139	173.3081	152.1085	147.0945	155.1570	159.3316	182.5387	200.0755	227.7943	(45)
Energy content (annual)										Total = Sum(45)m =		2228.5693	
Distribution loss (46)m = 0.15 x (45)m	34.6584	30.5274	32.0962	27.3921	25.9962	22.8163	22.0642	23.2735	23.8997	27.3808	30.0113	34.1691	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)

Total per year (kWh/year) = Sum(64)m = 2475.6013 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

93.6109	82.8294	87.9313	76.9623	74.4096	66.8193	65.6936	68.3743	69.2210	77.4788	82.7683	92.5262	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.7552	19.3227	15.7143	11.8967	8.8930	7.5078	8.1125	10.5449	14.1533	17.9709	20.9747	22.3598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	282.0814	285.0085	277.6323	261.9291	242.1067	223.4764	211.0302	208.1031	215.4793	231.1825	251.0049	269.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	(71)
Water heating gains (Table 5)													
	125.8211	123.2580	118.1873	106.8921	100.0129	92.8046	88.2978	91.9010	96.1402	104.1381	114.9560	124.3632	(72)
Total internal gains													
	522.9304	520.8621	504.8066	473.9908	444.2853	417.0615	400.7133	403.8217	419.0457	446.5643	480.2084	509.6310	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	11.8100	33.4622	0.6300	0.8270	0.7700	142.6869	(77)
Southwest	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(79)

Solar gains	237.8920	432.4913	618.4356	806.0340	893.6844	862.2965	841.6682	750.0695	663.6383	475.1307	292.8315	208.1992	(83)
Total gains	760.8224	953.3534	1123.2423	1280.0248	1337.9696	1279.3581	1242.3814	1153.8912	1082.6839	921.6950	773.0399	717.8302	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000	(85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	79.6469	79.6469	80.2217	81.9968	82.3004	83.5373	84.1698	84.1698	82.9142	81.3965	80.8048	81.0996	
alpha	6.3098	6.3098	6.3481	6.4665	6.4867	6.5692	6.6113	6.6113	6.5276	6.4264	6.3870	6.4066	
util living area													
	0.8845	0.7655	0.6241	0.4641	0.3489	0.2724	0.2177	0.2383	0.3407	0.5560	0.7919	0.9054	(86)
MIT	20.7303	20.8890	20.9674	20.9952	20.9993	20.9999	21.0000	21.0000	20.9995	20.9880	20.8884	20.6918	(87)
Th 2	20.3367	20.3367	20.3411	20.3545	20.3568	20.3657	20.3702	20.3702	20.3612	20.3501	20.3456	20.3478	(88)
util rest of house													
	0.8685	0.7432	0.6000	0.4416	0.3272	0.2502	0.1952	0.2141	0.3143	0.5256	0.7669	0.8915	(89)
MIT 2	20.0414	20.2207	20.3088	20.3501	20.3562	20.3657	20.3702	20.3702	20.3609	20.3395	20.2318	20.0064	(90)
Living area fraction									fLA = Living area / (4) =			0.3370	(91)
MIT	20.2736	20.4459	20.5307	20.5675	20.5729	20.5794	20.5824	20.5824	20.5761	20.5580	20.4531	20.2374	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2736	20.4459	20.5307	20.5675	20.5729	20.5794	20.5824	20.5824	20.5761	20.5580	20.4531	20.2374	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8668	0.7469	0.6070	0.4491	0.3345	0.2577	0.2028	0.2222	0.3232	0.5354	0.7711	0.8889	(94)
Useful gains	659.5127	712.1003	681.7671	574.8005	447.5175	329.6864	251.9844	256.4141	349.9080	493.4880	596.1068	638.1040	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	767.3236	756.6545	694.6943	576.6309	447.7632	329.7195	251.9897	256.4237	350.0571	497.9093	639.9012	761.1189	(97)
Space heating kWh													
	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(98a)
Space heating requirement - total per year (kWh/year)												247.6148	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												247.6148	
Space heating per m2										(98c) / (4) =		3.7235	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(219)
Space cooling fuel requirement													

(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5760	10.4558	11.5760	11.2026	11.5760	11.2026	11.5760	11.5760	11.2026	11.5760	11.2026	11.5760	(231)
Lighting	19.0422	15.2763	13.7546	10.0772	7.7840	6.3596	7.1008	9.2299	11.9887	15.7298	17.7668	19.5714	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.3659	-24.1373	-40.6748	-53.4156	-62.3565	-58.8247	-58.3796	-51.5126	-41.7801	-29.4038	-16.9601	-12.3644	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.6228	-6.9252	-16.5691	-29.8250	-41.2999	-40.8780	-40.9539	-31.7592	-21.4223	-10.5980	-3.9084	-2.0636	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	247.6148	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2475.6013	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.2984	(230a)
Total electricity for the above, kWh/year	136.2984	(231)
Electricity for lighting (calculated in Appendix L)	153.6812	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-713.0011	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2300.1947	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	247.6148	25.1600	62.2999	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	25.1600	622.8613	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	136.2984	25.1600	34.2927	(249)
Energy for lighting	153.6812	25.1600	38.6662	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.1755	25.1600	-116.7865	
PV Unit electricity exported	-248.8256	5.8100	-14.4568	
Total			-131.2433	(252)
Total energy cost			626.8767	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	247.6148	0.1602	39.6760	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2475.6013	0.1413	349.7834	(264)
Space and water heating			389.4594	(265)
Pumps, fans and electric keep-hot	136.2984	0.1387	18.9063	(267)
Energy for lighting	153.6812	0.1443	22.1809	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.1755	0.1320	-61.2773	
PV Unit electricity exported	-248.8256	0.1228	-30.5608	
Total			-91.8382	(269)
Total CO2, kg/year			338.7085	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	247.6148	1.5930	394.4398	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	1.5225	3769.0221	(278)
Space and water heating			4163.4620	(279)
Pumps, fans and electric keep-hot	136.2984	1.5128	206.1922	(281)
Energy for lighting	153.6812	1.5338	235.7213	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.1755	1.4878	-690.5810	
PV Unit electricity exported	-248.8256	0.4508	-112.1583	
Total			-802.7393	(283)
Total Primary energy kWh/year			3802.6362	(286)

SAP 10 EPC IMPROVEMENTS

Unit 402 L03_Copy

Current energy efficiency rating: C 79
Current environmental impact rating: A 96

N Solar water heating — Not applicable
U Solar photovoltaic panels — Not applicable
V2 Wind turbine — Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 79
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£758	£758	£0
Space heating	£97	£97	£0
Water heating	£623	£623	£0
Lighting	£39	£39	£0
Generated (PV)	-£131	-£131	£0
Total cost of fuels	£627	£627	£0
Total cost of uses	£628	£628	£0
Delivered energy	35 kWh/m²	35 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	57 kWh/m²	57 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.5000 (1b)	x	2.4000 (2b)	=	159.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.6000	(5)

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2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation — 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) — 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = — 72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	43.9000	19.6900	24.2100	0.1400	3.3894	14.0000	338.9400	(29a)
Total net area of external elements Aum(A, m2)			43.9000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.7211			(33)
Party Wall 1			55.9300	0.0000	0.0000	20.0000	1118.6000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.5000			80.0000	5320.0000	(32d)
Party Ceiling 1			66.5000			80.0000	5320.0000	(32b)
Internal Wall 1			140.2900			9.0000	1262.6100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13437.1500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.0624 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.1600	0.0700	1.1312
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	22.1400	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.0392 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	30.7603 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.9354	15.7675	15.5996	14.7602	14.5923	13.7529	13.7529	13.5851	14.0887	14.5923	14.9281	15.2638	(38)
Heat transfer coeff	46.6957	46.5278	46.3600	45.5206	45.3527	44.5133	44.5133	44.3454	44.8490	45.3527	45.6884	46.0242	(39)
Average = Sum(39)m / 12 =												45.4786	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7022	0.6997	0.6971	0.6845	0.6820	0.6694	0.6694	0.6668	0.6744	0.6820	0.6870	0.6921	(40)
HLP (average)												0.6839	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.1583 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
83.0588	81.8106	79.9917	76.5116	73.9433	71.0793	69.4513	71.2564	73.2352	76.3103	79.8652	82.7406	(42a)

Hot water usage for baths

26.1000	25.7123	25.1665	24.1600	23.4064	22.5708	22.1194	22.6614	23.2516	24.1458	25.1729	26.0117	(42b)

Hot water usage for other uses

36.7327	35.3969	34.0612	32.7255	31.3897	30.0540	30.0540	31.3897	32.7255	34.0612	35.3969	36.7327	(42c)

Average daily hot water use (litres/day)		134.1695 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.8914	142.9198	139.2194	133.3971	128.7395	123.7040	121.6247	125.3076	129.2122	134.5173	140.4351	145.4849	(44)
Energy conte	231.0563	203.5159	213.9750	182.6139	173.3081	152.1085	147.0945	155.1570	159.3316	182.5387	200.0755	227.7943	(45)
Energy content (annual)										Total = Sum(45)m =		2228.5693	

Distribution loss (46)m = 0.15 x (45)m

34.6584	30.5274	32.0962	27.3921	25.9962	22.8163	22.0642	23.2735	23.8997	27.3808	30.0113	34.1691	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
									Total per year (kWh/year) = Sum(64)m =		2475.6013	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

93.6109	82.8294	87.9313	76.9623	74.4096	66.8193	65.6936	68.3743	69.2210	77.4788	82.7683	92.5262	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7552	19.3227	15.7143	11.8967	8.8930	7.5078	8.1125	10.5449	14.1533	17.9709	20.9747	22.3598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	282.0814	285.0085	277.6323	261.9291	242.1067	223.4764	211.0302	208.1031	215.4793	231.1825	251.0049	269.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	(71)
Water heating gains (Table 5)	125.8211	123.2580	118.1873	106.8921	100.0129	92.8046	88.2978	91.9010	96.1402	104.1381	114.9560	124.3632	(72)
Total internal gains	522.9304	520.8621	504.8066	473.9908	444.2853	417.0615	400.7133	403.8217	419.0457	446.5643	480.2084	509.6310	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	11.8100	36.7938	0.6300	0.8270	0.7700	156.8932	(77)
Southwest	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	261.5773	445.5629	609.6386	755.3718	846.0793	839.9609	809.8120	742.1401	660.1097	492.4419	313.3093	223.8557	(83)
Total gains	784.5077	966.4250	1114.4452	1229.3625	1290.3646	1257.0225	1210.5252	1145.9618	1079.1553	939.0062	793.5177	733.4867	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	79.9333	80.2217	80.5122	81.9968	82.3004	83.8523	83.8523	84.1698	83.2246	82.3004	81.6955	81.0996	
alpha	6.3289	6.3481	6.3675	6.4665	6.4867	6.5902	6.5902	6.6113	6.5483	6.4867	6.4464	6.4066	
util living area	0.8610	0.7342	0.5934	0.4467	0.3267	0.2266	0.1618	0.1780	0.2867	0.4994	0.7534	0.8867	(86)
MIT	20.7806	20.9169	20.9770	20.9964	20.9996	21.0000	21.0000	21.0000	20.9999	20.9943	20.9214	20.7412	(87)
Th 2	20.3389	20.3411	20.3434	20.3545	20.3568	20.3680	20.3680	20.3702	20.3635	20.3568	20.3523	20.3478	(88)
util rest of house	0.8427	0.7107	0.5685	0.4232	0.3042	0.2042	0.1386	0.1536	0.2603	0.4693	0.7265	0.8706	(89)
MIT 2	20.1020	20.2557	20.3211	20.3513	20.3564	20.3679	20.3680	20.3702	20.3634	20.3519	20.2739	20.0650	(90)
Living area fraction										fLA = Living area / (4) =		0.3370	(91)
MIT	20.3307	20.4785	20.5421	20.5687	20.5732	20.5809	20.5810	20.5824	20.5779	20.5684	20.4921	20.2928	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3307	20.4785	20.5421	20.5687	20.5732	20.5809	20.5810	20.5824	20.5779	20.5684	20.4921	20.2928	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8425	0.7157	0.5761	0.4310	0.3118	0.2118	0.1464	0.1618	0.2692	0.4793	0.7325	0.8692	(94)
Useful gains	660.9362	691.6463	641.9935	529.8378	402.2774	266.2236	177.2049	185.4711	290.4875	450.0389	581.2287	637.5157	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	748.5635	724.8350	650.9921	531.1672	402.4220	266.2311	177.2054	185.4720	290.5269	452.0934	611.8637	740.6597	(97)
Space heating kWh	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(98a)
Space heating requirement - total per year (kWh/year)												195.5822	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												195.5822	
Space heating per m2										(98c) / (4) =		2.9411	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5760	10.4558	11.5760	11.2026	11.5760	11.2026	11.5760	11.5760	11.2026	11.5760	11.2026	11.5760	(231)
Lighting	19.0422	15.2763	13.7546	10.0772	7.7840	6.3596	7.1008	9.2299	11.9887	15.7298	17.7668	19.5714	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.8374	-25.0495	-40.6440	-51.2425	-60.2341	-57.9825	-57.0592	-51.4970	-42.0573	-30.6737	-18.2140	-13.3632	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.1177	-7.4452	-16.6195	-27.6808	-38.7105	-39.7745	-39.2119	-31.7414	-21.6778	-11.4252	-4.4487	-2.3730	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	195.5822	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2475.6013	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.2984	(230a)
Total electricity for the above, kWh/year	136.2984	(231)
Electricity for lighting (calculated in Appendix L)	153.6812	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-708.0805	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2253.0826	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	195.5822	16.4900	32.2515	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	16.4900	408.2267	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	136.2984	16.4900	22.4756	(249)
Energy for lighting	153.6812	16.4900	25.3420	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-463.8543	16.4900	-76.4896	
PV Unit electricity exported	-244.2261	5.5900	-13.6522	
Total			-90.1418	(252)
Total energy cost			398.1540	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2855	(257)
SAP value	79.1617	
SAP rating (Section 12)	79	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	195.5822	0.1606	31.4176	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2475.6013	0.1413	349.7834	(264)
Space and water heating			381.2010	(265)
Pumps, fans and electric keep-hot	136.2984	0.1387	18.9063	(267)
Energy for lighting	153.6812	0.1443	22.1809	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-463.8543	0.1323	-61.3768	
PV Unit electricity exported	-244.2261	0.1233	-30.1190	
Total			-91.4957	(269)
Total CO2, kg/year			330.7925	(272)
CO2 emissions per m2			4.9700	(273)
EI value			96.0246	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.5000	(1b)	x 2.4000	(2b) =	159.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		159.6000	(5)

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2. Ventilation rate

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m3 per hour

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery		
If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	43.9000	19.6900	24.2100	0.1400	3.3894	14.0000	338.9400	(29a)
Total net area of external elements Aum(A, m2)			43.9000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.7211			(33)
Party Wall 1			55.9300	0.0000	0.0000	20.0000	1118.6000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.5000			80.0000	5320.0000	(32d)
Party Ceiling 1			66.5000			80.0000	5320.0000	(32b)
Internal Wall 1			140.2900			9.0000	1262.6100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13437.1500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.0624 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.1600	0.0700	1.1312
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	22.1400	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.0392 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	30.7603 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.1032	16.1032	15.7675	14.7602	14.5923	13.9208	13.5851	13.5851	14.2566	15.0960	15.4317	15.2638	(38)
Heat transfer coeff	46.8636	46.8636	46.5278	45.5206	45.3527	44.6812	44.3454	44.3454	45.0169	45.8563	46.1921	46.0242	(39)
Average = Sum(39)m / 12 =												45.6325	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7047	0.7047	0.6997	0.6845	0.6820	0.6719	0.6668	0.6668	0.6769	0.6896	0.6946	0.6921	(40)
HLP (average)												0.6862	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.1583 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
83.0588	81.8106	79.9917	76.5116	73.9433	71.0793	69.4513	71.2564	73.2352	76.3103	79.8652	82.7406	(42a)

Hot water usage for baths

26.1000	25.7123	25.1665	24.1600	23.4064	22.5708	22.1194	22.6614	23.2516	24.1458	25.1729	26.0117	(42b)

Hot water usage for other uses

36.7327	35.3969	34.0612	32.7255	31.3897	30.0540	30.0540	31.3897	32.7255	34.0612	35.3969	36.7327	(42c)

Average daily hot water use (litres/day)		134.1695 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.8914	142.9198	139.2194	133.3971	128.7395	123.7040	121.6247	125.3076	129.2122	134.5173	140.4351	145.4849	(44)
Energy conte	231.0563	203.5159	213.9750	182.6139	173.3081	152.1085	147.0945	155.1570	159.3316	182.5387	200.0755	227.7943	(45)
Energy content (annual)										Total = Sum(45)m =		2228.5693	
Distribution loss (46)m = 0.15 x (45)m	34.6584	30.5274	32.0962	27.3921	25.9962	22.8163	22.0642	23.2735	23.8997	27.3808	30.0113	34.1691	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
										Total per year (kWh/year) = Sum(64)m =		2475.6013	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	93.6109	82.8294	87.9313	76.9623	74.4096	66.8193	65.6936	68.3743	69.2210	77.4788	82.7683	92.5262	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.7552	19.3227	15.7143	11.8967	8.8930	7.5078	8.1125	10.5449	14.1533	17.9709	20.9747	22.3598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	282.0814	285.0085	277.6323	261.9291	242.1067	223.4764	211.0302	208.1031	215.4793	231.1825	251.0049	269.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	(71)
Water heating gains (Table 5)													
	125.8211	123.2580	118.1873	106.8921	100.0129	92.8046	88.2978	91.9010	96.1402	104.1381	114.9560	124.3632	(72)
Total internal gains													
	522.9304	520.8621	504.8066	473.9908	444.2853	417.0615	400.7133	403.8217	419.0457	446.5643	480.2084	509.6310	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	11.8100	33.4622	0.6300	0.8270	0.7700	142.6869	(77)
Southwest	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(79)

Solar gains	237.8920	432.4913	618.4356	806.0340	893.6844	862.2965	841.6682	750.0695	663.6383	475.1307	292.8315	208.1992	(83)
Total gains	760.8224	953.3534	1123.2423	1280.0248	1337.9696	1279.3581	1242.3814	1153.8912	1082.6839	921.6950	773.0399	717.8302	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	79.6469	79.6469	80.2217	81.9968	82.3004	83.5373	84.1698	84.1698	82.9142	81.3965	80.8048	81.0996	
alpha	6.3098	6.3098	6.3481	6.4665	6.4867	6.5692	6.6113	6.6113	6.5276	6.4264	6.3870	6.4066	
util living area													
	0.8845	0.7655	0.6241	0.4641	0.3489	0.2724	0.2177	0.2383	0.3407	0.5560	0.7919	0.9054	(86)
MIT	20.7303	20.8890	20.9674	20.9952	20.9993	20.9999	21.0000	21.0000	20.9995	20.9880	20.8884	20.6918	(87)
Th 2	20.3367	20.3367	20.3411	20.3545	20.3568	20.3657	20.3702	20.3702	20.3612	20.3501	20.3456	20.3478	(88)
util rest of house													
	0.8685	0.7432	0.6000	0.4416	0.3272	0.2502	0.1952	0.2141	0.3143	0.5256	0.7669	0.8915	(89)
MIT 2	20.0414	20.2207	20.3088	20.3501	20.3562	20.3657	20.3702	20.3702	20.3609	20.3395	20.2318	20.0064	(90)
Living area fraction										fLA = Living area / (4) =		0.3370	(91)
MIT	20.2736	20.4459	20.5307	20.5675	20.5729	20.5794	20.5824	20.5824	20.5761	20.5580	20.4531	20.2374	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2736	20.4459	20.5307	20.5675	20.5729	20.5794	20.5824	20.5824	20.5761	20.5580	20.4531	20.2374	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8668	0.7469	0.6070	0.4491	0.3345	0.2577	0.2028	0.2222	0.3232	0.5354	0.7711	0.8889	(94)
Useful gains	659.5127	712.1003	681.7671	574.8005	447.5175	329.6864	251.9844	256.4141	349.9080	493.4880	596.1068	638.1040	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	767.3236	756.6545	694.6943	576.6309	447.7632	329.7195	251.9897	256.4237	350.0571	497.9093	639.9012	761.1189	(97)
Space heating kWh													
	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(98a)
Space heating requirement - total per year (kWh/year)												247.6148	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												247.6148	
Space heating per m2											(98c) / (4) =	3.7235	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement												

	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5760	10.4558	11.5760	11.2026	11.5760	11.2026	11.5760	11.5760	11.2026	11.5760	11.2026	11.5760	(231)
Lighting	19.0422	15.2763	13.7546	10.0772	7.7840	6.3596	7.1008	9.2299	11.9887	15.7298	17.7668	19.5714	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.3659	-24.1373	-40.6748	-53.4156	-62.3565	-58.8247	-58.3796	-51.5126	-41.7801	-29.4038	-16.9601	-12.3644	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.6228	-6.9252	-16.5691	-29.8250	-41.2999	-40.8780	-40.9539	-31.7592	-21.4223	-10.5980	-3.9084	-2.0636	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	247.6148	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2475.6013	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.2984	(230a)
Total electricity for the above, kWh/year	136.2984	(231)
Electricity for lighting (calculated in Appendix L)	153.6812	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-713.0011	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2300.1947	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	247.6148	25.1600	62.2999	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	25.1600	622.8613	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	136.2984	25.1600	34.2927	(249)
Energy for lighting	153.6812	25.1600	38.6662	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.1755	25.1600	-116.7865	
PV Unit electricity exported	-248.8256	5.8100	-14.4568	
Total			-131.2433	(252)
Total energy cost			626.8767	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	247.6148	0.1602	39.6760	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2475.6013	0.1413	349.7834	(264)
Space and water heating			389.4594	(265)
Pumps, fans and electric keep-hot	136.2984	0.1387	18.9063	(267)
Energy for lighting	153.6812	0.1443	22.1809	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.1755	0.1320	-61.2773	
PV Unit electricity exported	-248.8256	0.1228	-30.5608	
Total			-91.8382	(269)
Total CO2, kg/year			338.7085	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	

Space heating - main system 1	247.6148	1.5930	394.4398	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	1.5225	3769.0221	(278)
Space and water heating			4163.4620	(279)
Pumps, fans and electric keep-hot	136.2984	1.5128	206.1922	(281)
Energy for lighting	153.6812	1.5338	235.7213	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.1755	1.4878	-690.5810	
PV Unit electricity exported	-248.8256	0.4508	-112.1583	
Total			-802.7393	(283)
Total Primary energy kWh/year			3802.6362	(286)

Predicted Energy Assessment

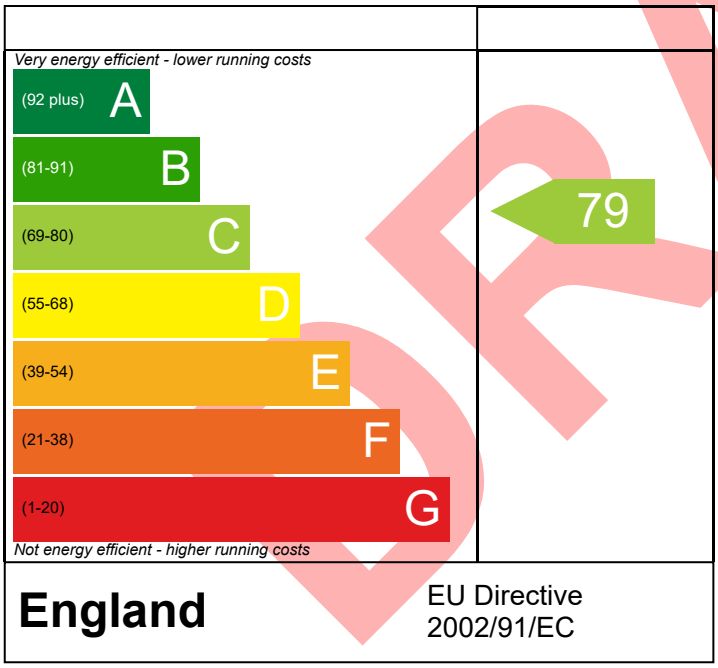
elmhurst energy

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	66.5 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

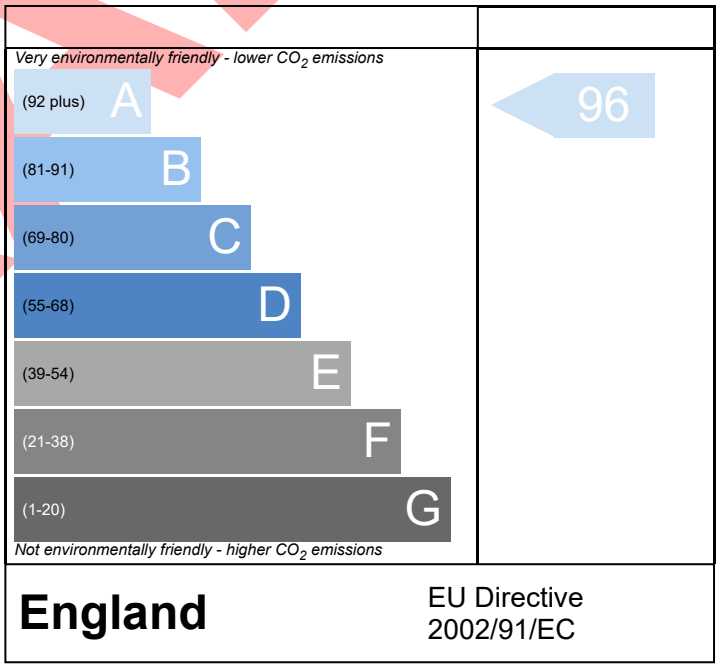
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:23

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	49 m^2
Site Reference	Unit 403 L03_Copy	Plot Reference	Unit 403 L03_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.77 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	5.62 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*64.09 kWh_{PE}/m^2*	
Dwelling primary energy	63.15 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*14.4 kWh/m^2*	
Dwelling fabric energy efficiency	13.7 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	7.88	0.14 **(!)**
Party wall: Party Wall (1)	24.84	0 **(!)**
Party wall: Party Wall (2)	39.01	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	6.29	North East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.63 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 403 L03_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 403 L03_Copy	**Prop Type Ref**	Unit 403 L03
Property			

SAP Rating	79 C	**DER**	5.62	**TER**	11.77
Environmental	96 A	**% DER < TER**			52.25
CO_2 Emissions (t/year)	0.27	**DFEE**	13.68	**TFEE**	14.36
Compliance Check	See BREL	**% DFEE < TFEE**			4.74
% DPER < TPER	1.47	**DPER**	63.15	**TPER**	64.09

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.8100	(1b)	x 2.4000	(2b) =	117.1440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.8100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		117.1440	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.2900	1.2357	7.7728			(27)
External Wall 1	14.1700	6.2900	7.8800	0.1400	1.1032	14.0000	110.3200	(29a)
Total net area of external elements Aum(A, m2)			14.1700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		8.8760			(33)
Party Wall 1			24.8400	0.0000	0.0000	20.0000	496.8000	(32)
Wall to corridor			39.0100	0.0000	0.0000	20.0000	780.2000	(32)
Party Floor 1			48.8100			80.0000	3904.8000	(32d)
Party Ceiling 1			48.8100			80.0000	3904.8000	(32b)
Internal Wall 1			72.6800			9.0000	654.1200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9851.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		201.8242 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.7100	0.0500	0.1355

E4 Jamb	9.2800	0.0500	0.4640	
E7 Party floor between dwellings (in blocks of flats)	5.2500	0.0700	0.3675	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	20.8400	0.0000	0.0000	
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.2910 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 10.1670 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.1418	11.0295	10.9171	10.3554	10.2430	9.6813	9.6813	9.5689	9.9060	10.2430	10.4677	10.6924	(38)
Heat transfer coeff	21.3088	21.1965	21.0841	20.5224	20.4100	19.8483	19.8483	19.7360	20.0730	20.4100	20.6347	20.8594	(39)
Average = Sum(39)m / 12 =												20.4943	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4366	0.4343	0.4320	0.4205	0.4182	0.4066	0.4066	0.4043	0.4112	0.4182	0.4228	0.4274	(40)
HLP (average)												0.4199	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6551 (42)
Hot water usage for mixer showers

71.4595	70.3856	68.8207	65.8266	63.6170	61.1529	59.7523	61.3053	63.0077	65.6534	68.7119	71.1857	(42a)

Hot water usage for baths

22.4723	22.1385	21.6685	20.8020	20.1531	19.4336	19.0450	19.5117	20.0198	20.7897	21.6741	22.3963	(42b)

Hot water usage for other uses

31.5802	30.4318	29.2834	28.1350	26.9867	25.8383	25.8383	26.9867	28.1350	29.2834	30.4318	31.5802	(42c)

Average daily hot water use (litres/day) 115.4278 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	125.5119	122.9558	119.7726	114.7636	110.7568	106.4248	104.6356	107.8037	111.1626	115.7265	120.8177	125.1621	(44)
Energy conte	198.7801	175.0875	184.0861	157.1056	149.0999	130.8617	126.5476	133.4834	137.0746	157.0398	172.1270	195.9736	(45)
Energy content (annual)											Total = Sum(45)m =	1917.2669	
Distribution loss (46)m = 0.15 x (45)m	29.8170	26.2631	27.6129	23.5658	22.3650	19.6293	18.9821	20.0225	20.5612	23.5560	25.8191	29.3960	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
										Total per year (kWh/year) = Sum(64)m =		2164.2989	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	82.8790	73.3769	77.9933	68.4808	66.3603	59.7547	58.8617	61.1679	61.8205	69.0004	73.4754	81.9459	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.4855	15.5304	12.6302	9.5619	7.1476	6.0343	6.5203	8.4753	11.3756	14.4439	16.8582	17.9715	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.1398	217.3723	211.7465	199.7699	184.6516	170.4425	160.9500	158.7175	164.3433	176.3199	191.4382	205.6473	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	(71)
Water heating gains (Table 5)	111.3965	109.1918	104.8296	95.1122	89.1940	82.9927	79.1152	82.2149	85.8618	92.7424	102.0492	110.1423	(72)
Total internal gains	423.7103	421.7830	408.8948	384.1325	360.6817	339.1579	326.2739	329.0962	341.2691	363.1946	390.0340	413.4494	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.2900	11.2829	0.6300	0.8270	0.7700	25.6243	(75)

Solar gains	25.6243	52.1590	93.9740	154.3323	207.4529	221.1667	206.8969	164.9406	114.5088	63.7425	32.2420	20.9261	(83)
Total gains	449.3346	473.9420	502.8688	538.4647	568.1345	560.3246	533.1709	494.0368	455.7778	426.9371	422.2760	434.3755	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	128.4162	129.0969	129.7848	133.3373	134.0712	137.8657	137.8657	138.6505	136.3224	134.0712	132.6113	131.1828	
alpha	9.5611	9.6065	9.6523	9.8892	9.9381	10.1910	10.1910	10.2434	10.0882	9.9381	9.8408	9.7455	
util living area													
	0.7726	0.7112	0.6060	0.4610	0.3341	0.2267	0.1638	0.1838	0.3039	0.4969	0.6743	0.7854	(86)
MIT	20.9734	20.9871	20.9970	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9997	20.9936	20.9715	(87)
Th 2	20.5793	20.5815	20.5836	20.5943	20.5964	20.6071	20.6071	20.6093	20.6028	20.5964	20.5921	20.5879	(88)
util rest of house													
	0.7562	0.6942	0.5890	0.4456	0.3196	0.2128	0.1492	0.1682	0.2864	0.4777	0.6555	0.7694	(89)
MIT 2	20.5513	20.5682	20.5806	20.5941	20.5964	20.6071	20.6071	20.6093	20.6028	20.5961	20.5859	20.5578	(90)
Living area fraction										fLA = Living area / (4) =		0.5530	(91)
MIT	20.7847	20.7999	20.8108	20.8184	20.8196	20.8244	20.8244	20.8253	20.8225	20.8193	20.8113	20.7866	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7847	20.7999	20.8108	20.8184	20.8196	20.8244	20.8244	20.8253	20.8225	20.8193	20.8113	20.7866	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7643	0.7031	0.5983	0.4541	0.3276	0.2205	0.1573	0.1768	0.2961	0.4883	0.6657	0.7772	(94)
Useful gains	343.4042	333.2384	300.8562	244.5404	186.1291	123.5433	83.8467	87.3382	134.9394	208.4897	281.0919	337.5907	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	351.2699	337.0213	301.7319	244.5949	186.1310	123.5433	83.8467	87.3382	134.9399	208.5761	282.9300	345.9870	(97)
Space heating kWh	5.8521	2.5421	0.6515	0.0392	0.0014	0.0000	0.0000	0.0000	0.0000	0.0643	1.3235	6.2469	(98a)
Space heating requirement - total per year (kWh/year)												16.7210	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	5.8521	2.5421	0.6515	0.0392	0.0014	0.0000	0.0000	0.0000	0.0000	0.0643	1.3235	6.2469	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												16.7210	
Space heating per m2											(98c) / (4) =	0.3426	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	5.8521	2.5421	0.6515	0.0392	0.0014	0.0000	0.0000	0.0000	0.0000	0.0643	1.3235	6.2469	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	5.8521	2.5421	0.6515	0.0392	0.0014	0.0000	0.0000	0.0000	0.0000	0.0643	1.3235	6.2469	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.4966	7.6744	8.4966	8.2225	8.4966	8.2225	8.4966	8.4966	8.2225	8.4966	8.2225	8.4966	(231)
Lighting	15.3049	12.2782	11.0551	8.0995	6.2563	5.1114	5.7072	7.4184	9.6358	12.6427	14.2798	15.7303	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.6124	-18.5300	-30.3052	-38.4596	-45.4028	-43.7828	-43.0940	-38.8073	-31.5720	-22.8790	-13.4504	-9.7805	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.2732	-5.2742	-11.6436	-19.3564	-27.0799	-27.8299	-27.4302	-22.1697	-15.1176	-7.9609	-3.1514	-1.7472	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												16.7210	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2164.2989	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)													
mechanical ventilation fans (SFP = 0.7000)												100.0410	(230a)
Total electricity for the above, kWh/year												100.0410	(231)
Electricity for lighting (calculated in Appendix L)												123.5196	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-518.7101	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)

Appendix Q - special features

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1885.8704	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	16.7210	16.4900	2.7573	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	16.4900	356.8929	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	100.0410	16.4900	16.4968	(249)
Energy for lighting	123.5196	16.4900	20.3684	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.6760	16.4900	-57.3318	
PV Unit electricity exported	-171.0341	5.5900	-9.5608	
Total			-66.8926	(252)
Total energy cost			329.6227	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2649	(257)
SAP value	79.4953	
SAP rating (Section 12)	79	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	16.7210	0.1611	2.6929	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2164.2989	0.1413	305.7097	(264)
Space and water heating			308.4027	(265)
Pumps, fans and electric keep-hot	100.0410	0.1387	13.8769	(267)
Energy for lighting	123.5196	0.1443	17.8277	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.6760	0.1322	-45.9596	
PV Unit electricity exported	-171.0341	0.1234	-21.1138	
Total			-67.0733	(269)
Total CO2, kg/year			273.0339	(272)
CO2 emissions per m2			5.5900	(273)
EI value			96.0999	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.8100	(1b)	x 2.4000	(2b) =	117.1440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 48.8100						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		117.1440	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor (20) = 1 - [0.075 x (19)] =		0.7750	(20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.2900	1.2357	7.7728			(27)
External Wall 1	14.1700	6.2900	7.8800	0.1400	1.1032	14.0000	110.3200	(29a)
Total net area of external elements Aum(A, m2)			14.1700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	8.8760			(33)
Party Wall 1			24.8400	0.0000	0.0000	20.0000	496.8000	(32)
Wall to corridor			39.0100	0.0000	0.0000	20.0000	780.2000	(32)
Party Floor 1			48.8100			80.0000	3904.8000	(32d)
Party Ceiling 1			48.8100			80.0000	3904.8000	(32b)
Internal Wall 1			72.6800			9.0000	654.1200	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9851.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 201.8242 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.7100	0.0500	0.1355
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.2500	0.0700	0.3675
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	20.8400	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.2910 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 10.1670 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.2542	11.2542	11.0295	10.3554	10.2430	9.7936	9.5689	9.5689	10.0183	10.5801	10.8048	10.6924	(38)
Heat transfer coeff	21.4212	21.4212	21.1965	20.5224	20.4100	19.9607	19.7360	19.7360	20.1854	20.7471	20.9718	20.8594	(39)

Average = Sum(39)m / 12 = 20.5973

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4389	0.4389	0.4343	0.4205	0.4182	0.4089	0.4043	0.4043	0.4135	0.4251	0.4297	0.4274	(40)
HLP (average)												0.4220	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6551 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	71.4595	70.3856	68.8207	65.8266	63.6170	61.1529	59.7523	61.3053	63.0077	65.6534	68.7119	71.1857	(42a)
Hot water usage for baths	22.4723	22.1385	21.6685	20.8020	20.1531	19.4336	19.0450	19.5117	20.0198	20.7897	21.6741	22.3963	(42b)
Hot water usage for other uses	31.5802	30.4318	29.2834	28.1350	26.9867	25.8383	25.8383	26.9867	28.1350	29.2834	30.4318	31.5802	(42c)

Average daily hot water use (litres/day) 115.4278 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	125.5119	122.9558	119.7726	114.7636	110.7568	106.4248	104.6356	107.8037	111.1626	115.7265	120.8177	125.1621	(44)
Energy conte	198.7801	175.0875	184.0861	157.1056	149.0999	130.8617	126.5476	133.4834	137.0746	157.0398	172.1270	195.9736	(45)

Energy content (annual) Total = Sum(45)m = 1917.2669

Distribution loss (46)m = 0.15 x (45)m	29.8170	26.2631	27.6129	23.5658	22.3650	19.6293	18.9821	20.0225	20.5612	23.5560	25.8191	29.3960	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)

Total per year (kWh/year) = Sum(64)m = 2164.2989 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	82.8790	73.3769	77.9933	68.4808	66.3603	59.7547	58.8617	61.1679	61.8205	69.0004	73.4754	81.9459	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	17.4855	15.5304	12.6302	9.5619	7.1476	6.0343	6.5203	8.4753	11.3756	14.4439	16.8582	17.9715	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	215.1398	217.3723	211.7465	199.7699	184.6516	170.4425	160.9500	158.7175	164.3433	176.3199	191.4382	205.6473	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	(71)

Water heating gains (Table 5)

	111.3965	109.1918	104.8296	95.1122	89.1940	82.9927	79.1152	82.2149	85.8618	92.7424	102.0492	110.1423	(72)

Total internal gains

	423.7103	421.7830	408.8948	384.1325	360.6817	339.1579	326.2739	329.0962	341.2691	363.1946	390.0340	413.4494	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.2900	10.0309	0.6300	0.8270	0.7700	22.7809	(75)

Solar gains	22.7809	49.3199	92.7016	160.6228	214.7931	223.1785	211.1088	162.9125	112.0170	59.8425	29.4243	19.0490	(83)
Total gains	446.4911	471.1029	501.5964	544.7552	575.4748	562.3364	537.3828	492.0087	453.2861	423.0371	419.4582	432.4984	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	127.7427	127.7427	129.0969	133.3373	134.0712	137.0897	138.6505	138.6505	135.5637	131.8932	130.4800	131.1828	
alpha	9.5162	9.5162	9.6065	9.8892	9.9381	10.1393	10.2434	10.2434	10.0376	9.7929	9.6987	9.7455	
util living area	0.7948	0.7453	0.6471	0.4933	0.3653	0.2769	0.2240	0.2487	0.3651	0.5534	0.7114	0.8068	(86)
MIT	20.9651	20.9797	20.9943	20.9996	21.0000	21.0000	21.0000	21.0000	21.0000	20.9990	20.9890	20.9634	(87)
Th 2	20.5772	20.5772	20.5815	20.5943	20.5964	20.6050	20.6093	20.6093	20.6007	20.5900	20.5857	20.5879	(88)
util rest of house	0.7789	0.7287	0.6302	0.4781	0.3510	0.2628	0.2097	0.2330	0.3474	0.5335	0.6926	0.7915	(89)
MIT 2	20.5401	20.5560	20.5757	20.5939	20.5964	20.6050	20.6093	20.6093	20.6007	20.5891	20.5747	20.5487	(90)
Living area fraction										fLA = Living area / (4) =		0.5530	(91)
MIT	20.7751	20.7903	20.8072	20.8182	20.8196	20.8234	20.8253	20.8253	20.8215	20.8158	20.8038	20.7780	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7751	20.7903	20.8072	20.8182	20.8196	20.8234	20.8253	20.8253	20.8215	20.8158	20.8038	20.7780	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7864	0.7371	0.6393	0.4865	0.3589	0.2706	0.2176	0.2417	0.3572	0.5445	0.7025	0.7986	(94)
Useful gains	351.1385	347.2445	320.6771	265.0035	206.5358	152.1681	116.9421	118.9157	161.9131	230.3437	294.6735	345.4051	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	361.4839	353.2416	322.3390	265.1134	206.5408	152.1683	116.9421	118.9157	161.9165	230.6198	297.8783	356.2377	(97)
Space heating kWh	7.6970	4.0300	1.2365	0.0791	0.0037	0.0000	0.0000	0.0000	0.0000	0.2055	2.3075	8.0594	(98a)
Space heating requirement - total per year (kWh/year)												23.6187	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	7.6970	4.0300	1.2365	0.0791	0.0037	0.0000	0.0000	0.0000	0.0000	0.2055	2.3075	8.0594	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												23.6187	
Space heating per m2										(98c) / (4) =		0.4839	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	7.6970	4.0300	1.2365	0.0791	0.0037	0.0000	0.0000	0.0000	0.0000	0.2055	2.3075	8.0594	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	7.6970	4.0300	1.2365	0.0791	0.0037	0.0000	0.0000	0.0000	0.0000	0.2055	2.3075	8.0594	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating

Water heating requirement	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(219)

Space cooling fuel requirement

(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.4966	7.6744	8.4966	8.2225	8.4966	8.2225	8.4966	8.4966	8.2225	8.4966	8.2225	8.4966	(231)
Lighting	15.3049	12.2782	11.0551	8.0995	6.2563	5.1114	5.7072	7.4184	9.6358	12.6427	14.2798	15.7303	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.5135	-17.8235	-30.3039	-40.1107	-47.0328	-44.4324	-44.1129	-38.8193	-31.3606	-21.9085	-12.4971	-9.0348	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.9317	-4.9317	-11.6305	-20.8679	-28.9016	-28.6057	-28.6546	-22.1822	-14.9388	-7.3951	-2.7904	-1.5346	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	23.6187	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2164.2989	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	100.0410	(230a)
Total electricity for the above, kWh/year	100.0410	(231)
Electricity for lighting (calculated in Appendix L)	123.5196	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-522.3147	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1889.1634	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	23.6187	25.1600	5.9425	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	25.1600	544.5376	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	100.0410	25.1600	25.1703	(249)
Energy for lighting	123.5196	25.1600	31.0775	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.9499	25.1600	-87.5442	
PV Unit electricity exported	-174.3648	5.8100	-10.1306	
Total			-97.6748	(252)
Total energy cost			509.0531	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	23.6187	0.1605	3.7905	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2164.2989	0.1413	305.7097	(264)
Space and water heating			309.5002	(265)
Pumps, fans and electric keep-hot	100.0410	0.1387	13.8769	(267)
Energy for lighting	123.5196	0.1443	17.8277	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.9499	0.1319	-45.8876	
PV Unit electricity exported	-174.3648	0.1230	-21.4411	
Total			-67.3287	(269)
Total CO2, kg/year			273.8761	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	23.6187	1.5940	37.6472	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	1.5223	3294.7406	(278)
Space and water heating			3332.3878	(279)
Pumps, fans and electric keep-hot	100.0410	1.5128	151.3420	(281)
Energy for lighting	123.5196	1.5338	189.4585	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.9499	1.4873	-517.4911	
PV Unit electricity exported	-174.3648	0.4513	-78.6883	
Total			-596.1795	(283)
Total Primary energy kWh/year			3077.0088	(286)

SAP 10 EPC IMPROVEMENTS

Unit 403 L03_Copy

Current energy efficiency rating: C 79
Current environmental impact rating: A 96

N Solar water heating — Not applicable
U Solar photovoltaic panels — Not applicable
V2 Wind turbine — Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 79
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£607	£607	£0
Space heating	£31	£31	£0
Water heating	£545	£545	£0
Lighting	£31	£31	£0
Generated (PV)	-£98	-£98	£0
Total cost of fuels	£509	£509	£0
Total cost of uses	£509	£509	£0
Delivered energy	39 kWh/m²	39 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	63 kWh/m²	63 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.8100 (1b)	x	2.4000 (2b)	=	117.1440	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.8100					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	117.1440	(5)

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2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.2900	1.2357	7.7728			(27)
External Wall 1	14.1700	6.2900	7.8800	0.1400	1.1032	14.0000	110.3200	(29a)
Total net area of external elements Aum(A, m2)			14.1700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	8.8760			(33)
Party Wall 1			24.8400	0.0000	0.0000	20.0000	496.8000	(32)
Wall to corridor			39.0100	0.0000	0.0000	20.0000	780.2000	(32)
Party Floor 1			48.8100			80.0000	3904.8000	(32d)
Party Ceiling 1			48.8100			80.0000	3904.8000	(32b)
Internal Wall 1			72.6800			9.0000	654.1200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9851.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		201.8242 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.7100	0.0500	0.1355
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.2500	0.0700	0.3675
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	20.8400	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.2910 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	10.1670 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.1418	11.0295	10.9171	10.3554	10.2430	9.6813	9.6813	9.5689	9.9060	10.2430	10.4677	10.6924	(38)
Heat transfer coeff	21.3088	21.1965	21.0841	20.5224	20.4100	19.8483	19.8483	19.7360	20.0730	20.4100	20.6347	20.8594	(39)
Average = Sum(39)m / 12 =												20.4943	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4366	0.4343	0.4320	0.4205	0.4182	0.4066	0.4066	0.4043	0.4112	0.4182	0.4228	0.4274	(40)
HLP (average)												0.4199	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.6551 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
71.4595	70.3856	68.8207	65.8266	63.6170	61.1529	59.7523	61.3053	63.0077	65.6534	68.7119	71.1857	(42a)

Hot water usage for baths

22.4723	22.1385	21.6685	20.8020	20.1531	19.4336	19.0450	19.5117	20.0198	20.7897	21.6741	22.3963	(42b)

Hot water usage for other uses

31.5802	30.4318	29.2834	28.1350	26.9867	25.8383	25.8383	26.9867	28.1350	29.2834	30.4318	31.5802	(42c)

Average daily hot water use (litres/day)		115.4278 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	125.5119	122.9558	119.7726	114.7636	110.7568	106.4248	104.6356	107.8037	111.1626	115.7265	120.8177	125.1621	(44)
Energy conte	198.7801	175.0875	184.0861	157.1056	149.0999	130.8617	126.5476	133.4834	137.0746	157.0398	172.1270	195.9736	(45)
Energy content (annual)										Total = Sum(45)m =		1917.2669	

Distribution loss (46)m = 0.15 x (45)m

29.8170	26.2631	27.6129	23.5658	22.3650	19.6293	18.9821	20.0225	20.5612	23.5560	25.8191	29.3960	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
									Total per year (kWh/year) = Sum(64)m =		2164.2989	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

82.8790	73.3769	77.9933	68.4808	66.3603	59.7547	58.8617	61.1679	61.8205	69.0004	73.4754	81.9459	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	17.4855	15.5304	12.6302	9.5619	7.1476	6.0343	6.5203	8.4753	11.3756	14.4439	16.8582	17.9715	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	215.1398	217.3723	211.7465	199.7699	184.6516	170.4425	160.9500	158.7175	164.3433	176.3199	191.4382	205.6473	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	(71)
Water heating gains (Table 5)													
	111.3965	109.1918	104.8296	95.1122	89.1940	82.9927	79.1152	82.2149	85.8618	92.7424	102.0492	110.1423	(72)
Total internal gains													
	423.7103	421.7830	408.8948	384.1325	360.6817	339.1579	326.2739	329.0962	341.2691	363.1946	390.0340	413.4494	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.2900	11.2829	0.6300	0.8270	0.7700	25.6243	(75)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	25.6243	52.1590	93.9740	154.3323	207.4529	221.1667	206.8969	164.9406	114.5088	63.7425	32.2420	20.9261	(83)
Total gains	449.3346	473.9420	502.8688	538.4647	568.1345	560.3246	533.1709	494.0368	455.7778	426.9371	422.2760	434.3755	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	128.4162	129.0969	129.7848	133.3373	134.0712	137.8657	137.8657	138.6505	136.3224	134.0712	132.6113	131.1828	
alpha	9.5611	9.6065	9.6523	9.8892	9.9381	10.1910	10.1910	10.2434	10.0882	9.9381	9.8408	9.7455	
util living area	0.7726	0.7112	0.6060	0.4610	0.3341	0.2267	0.1638	0.1838	0.3039	0.4969	0.6743	0.7854	(86)
MIT	20.9734	20.9871	20.9970	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9997	20.9936	20.9715	(87)
Th 2	20.5793	20.5815	20.5836	20.5943	20.5964	20.6071	20.6071	20.6093	20.6028	20.5964	20.5921	20.5879	(88)
util rest of house	0.7562	0.6942	0.5890	0.4456	0.3196	0.2128	0.1492	0.1682	0.2864	0.4777	0.6555	0.7694	(89)
MIT 2	20.5513	20.5682	20.5806	20.5941	20.5964	20.6071	20.6071	20.6093	20.6028	20.5961	20.5859	20.5578	(90)
Living area fraction										fLA = Living area / (4) =		0.5530	(91)
MIT	20.7847	20.7999	20.8108	20.8184	20.8196	20.8244	20.8244	20.8253	20.8225	20.8193	20.8113	20.7866	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7847	20.7999	20.8108	20.8184	20.8196	20.8244	20.8244	20.8253	20.8225	20.8193	20.8113	20.7866	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7643	0.7031	0.5983	0.4541	0.3276	0.2205	0.1573	0.1768	0.2961	0.4883	0.6657	0.7772	(94)
Useful gains	343.4042	333.2384	300.8562	244.5404	186.1291	123.5433	83.8467	87.3382	134.9394	208.4897	281.0919	337.5907	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	351.2699	337.0213	301.7319	244.5949	186.1310	123.5433	83.8467	87.3382	134.9399	208.5761	282.9300	345.9870	(97)
Space heating kWh	5.8521	2.5421	0.6515	0.0392	0.0014	0.0000	0.0000	0.0000	0.0000	0.0643	1.3235	6.2469	(98a)
Space heating requirement - total per year (kWh/year)												16.7210	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	5.8521	2.5421	0.6515	0.0392	0.0014	0.0000	0.0000	0.0000	0.0000	0.0643	1.3235	6.2469	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												16.7210	
Space heating per m2										(98c) / (4) =		0.3426	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	5.8521	2.5421	0.6515	0.0392	0.0014	0.0000	0.0000	0.0000	0.0000	0.0643	1.3235	6.2469	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	5.8521	2.5421	0.6515	0.0392	0.0014	0.0000	0.0000	0.0000	0.0000	0.0643	1.3235	6.2469	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.4966	7.6744	8.4966	8.2225	8.4966	8.2225	8.4966	8.4966	8.2225	8.4966	8.2225	8.4966	(231)
Lighting	15.3049	12.2782	11.0551	8.0995	6.2563	5.1114	5.7072	7.4184	9.6358	12.6427	14.2798	15.7303	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.6124	-18.5300	-30.3052	-38.4596	-45.4028	-43.7828	-43.0940	-38.8073	-31.5720	-22.8790	-13.4504	-9.7805	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.2732	-5.2742	-11.6436	-19.3564	-27.0799	-27.8299	-27.4302	-22.1697	-15.1176	-7.9609	-3.1514	-1.7472	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	16.7210	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2164.2989	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	100.0410	(230a)
Total electricity for the above, kWh/year	100.0410	(231)
Electricity for lighting (calculated in Appendix L)	123.5196	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-518.7101	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1885.8704	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	16.7210	16.4900	2.7573	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	16.4900	356.8929	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	100.0410	16.4900	16.4968	(249)
Energy for lighting	123.5196	16.4900	20.3684	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.6760	16.4900	-57.3318	
PV Unit electricity exported	-171.0341	5.5900	-9.5608	
Total			-66.8926	(252)
Total energy cost			329.6227	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2649	(257)
SAP value	79.4953	
SAP rating (Section 12)	79	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	16.7210	0.1611	2.6929	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2164.2989	0.1413	305.7097	(264)
Space and water heating			308.4027	(265)
Pumps, fans and electric keep-hot	100.0410	0.1387	13.8769	(267)
Energy for lighting	123.5196	0.1443	17.8277	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.6760	0.1322	-45.9596	
PV Unit electricity exported	-171.0341	0.1234	-21.1138	
Total			-67.0733	(269)
Total CO2, kg/year			273.0339	(272)
CO2 emissions per m2			5.5900	(273)
EI value			96.0999	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.8100	(1b)	x 2.4000	(2b) =	117.1440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.8100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		117.1440	(5)

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2. Ventilation rate

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m3 per hour

Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												72.0000	(23c)
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.2900	1.2357	7.7728			(27)
External Wall 1	14.1700	6.2900	7.8800	0.1400	1.1032	14.0000	110.3200	(29a)
Total net area of external elements Aum(A, m2)			14.1700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		8.8760			(33)
Party Wall 1			24.8400	0.0000	0.0000	20.0000	496.8000	(32)
Wall to corridor			39.0100	0.0000	0.0000	20.0000	780.2000	(32)
Party Floor 1			48.8100			80.0000	3904.8000	(32d)
Party Ceiling 1			48.8100			80.0000	3904.8000	(32b)
Internal Wall 1			72.6800			9.0000	654.1200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9851.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		201.8242 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.7100	0.0500	0.1355
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.2500	0.0700	0.3675
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	20.8400	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.2910 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	10.1670 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.2542	11.2542	11.0295	10.3554	10.2430	9.7936	9.5689	9.5689	10.0183	10.5801	10.8048	10.6924	(38)
Heat transfer coeff	21.4212	21.4212	21.1965	20.5224	20.4100	19.9607	19.7360	19.7360	20.1854	20.7471	20.9718	20.8594	(39)
Average = Sum(39)m / 12 =												20.5973	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4389	0.4389	0.4343	0.4205	0.4182	0.4089	0.4043	0.4043	0.4135	0.4251	0.4297	0.4274	(40)
HLP (average)												0.4220	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.6551 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
71.4595	70.3856	68.8207	65.8266	63.6170	61.1529	59.7523	61.3053	63.0077	65.6534	68.7119	71.1857	(42a)

Hot water usage for baths

22.4723	22.1385	21.6685	20.8020	20.1531	19.4336	19.0450	19.5117	20.0198	20.7897	21.6741	22.3963	(42b)

Hot water usage for other uses

31.5802	30.4318	29.2834	28.1350	26.9867	25.8383	25.8383	26.9867	28.1350	29.2834	30.4318	31.5802	(42c)

Average daily hot water use (litres/day)		115.4278 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	125.5119	122.9558	119.7726	114.7636	110.7568	106.4248	104.6356	107.8037	111.1626	115.7265	120.8177	125.1621	(44)
Energy conte	198.7801	175.0875	184.0861	157.1056	149.0999	130.8617	126.5476	133.4834	137.0746	157.0398	172.1270	195.9736	(45)
Energy content (annual)										Total = Sum(45)m =		1917.2669	
Distribution loss (46)m = 0.15 x (45)m													
	29.8170	26.2631	27.6129	23.5658	22.3650	19.6293	18.9821	20.0225	20.5612	23.5560	25.8191	29.3960	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544 (64)
									Total per year (kWh/year) = Sum(64)m =			2164.2989 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						0.0000 (64a)
Heat gains from water heating, kWh/month												
	82.8790	73.3769	77.9933	68.4808	66.3603	59.7547	58.8617	61.1679	61.8205	69.0004	73.4754	81.9459 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	17.4855	15.5304	12.6302	9.5619	7.1476	6.0343	6.5203	8.4753	11.3756	14.4439	16.8582	17.9715	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	215.1398	217.3723	211.7465	199.7699	184.6516	170.4425	160.9500	158.7175	164.3433	176.3199	191.4382	205.6473	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	(71)
Water heating gains (Table 5)													
	111.3965	109.1918	104.8296	95.1122	89.1940	82.9927	79.1152	82.2149	85.8618	92.7424	102.0492	110.1423	(72)
Total internal gains													
	423.7103	421.7830	408.8948	384.1325	360.6817	339.1579	326.2739	329.0962	341.2691	363.1946	390.0340	413.4494	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.2900	10.0309	0.6300	0.8270	0.7700	22.7809	(75)

Solar gains	22.7809	49.3199	92.7016	160.6228	214.7931	223.1785	211.1088	162.9125	112.0170	59.8425	29.4243	19.0490	(83)
Total gains	446.4911	471.1029	501.5964	544.7552	575.4748	562.3364	537.3828	492.0087	453.2861	423.0371	419.4582	432.4984	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	127.7427	127.7427	129.0969	133.3373	134.0712	137.0897	138.6505	138.6505	135.5637	131.8932	130.4800	131.1828	
alpha	9.5162	9.5162	9.6065	9.8892	9.9381	10.1393	10.2434	10.2434	10.0376	9.7929	9.6987	9.7455	
util living area													
	0.7948	0.7453	0.6471	0.4933	0.3653	0.2769	0.2240	0.2487	0.3651	0.5534	0.7114	0.8068	(86)
MIT	20.9651	20.9797	20.9943	20.9996	21.0000	21.0000	21.0000	21.0000	21.0000	20.9990	20.9890	20.9634	(87)
Th 2	20.5772	20.5772	20.5815	20.5943	20.5964	20.6050	20.6093	20.6093	20.6007	20.5900	20.5857	20.5879	(88)
util rest of house													
	0.7789	0.7287	0.6302	0.4781	0.3510	0.2628	0.2097	0.2330	0.3474	0.5335	0.6926	0.7915	(89)
MIT 2	20.5401	20.5560	20.5757	20.5939	20.5964	20.6050	20.6093	20.6093	20.6007	20.5891	20.5747	20.5487	(90)
Living area fraction										fLA = Living area / (4) =		0.5530	(91)
MIT	20.7751	20.7903	20.8072	20.8182	20.8196	20.8234	20.8253	20.8253	20.8215	20.8158	20.8038	20.7780	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7751	20.7903	20.8072	20.8182	20.8196	20.8234	20.8253	20.8253	20.8215	20.8158	20.8038	20.7780	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7864	0.7371	0.6393	0.4865	0.3589	0.2706	0.2176	0.2417	0.3572	0.5445	0.7025	0.7986	(94)
Useful gains	351.1385	347.2445	320.6771	265.0035	206.5358	152.1681	116.9421	118.9157	161.9131	230.3437	294.6735	345.4051	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	361.4839	353.2416	322.3390	265.1134	206.5408	152.1683	116.9421	118.9157	161.9165	230.6198	297.8783	356.2377	(97)
Space heating kWh													
	7.6970	4.0300	1.2365	0.0791	0.0037	0.0000	0.0000	0.0000	0.0000	0.2055	2.3075	8.0594	(98a)
Space heating requirement - total per year (kWh/year)												23.6187	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	7.6970	4.0300	1.2365	0.0791	0.0037	0.0000	0.0000	0.0000	0.0000	0.2055	2.3075	8.0594	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												23.6187	
Space heating per m2											(98c) / (4) =	0.4839	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement												

	7.6970	4.0300	1.2365	0.0791	0.0037	0.0000	0.0000	0.0000	0.0000	0.2055	2.3075	8.0594 (98)
Space heating efficiency (main heating system 1)												
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)												
	7.6970	4.0300	1.2365	0.0791	0.0037	0.0000	0.0000	0.0000	0.0000	0.2055	2.3075	8.0594 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	8.4966	7.6744	8.4966	8.2225	8.4966	8.2225	8.4966	8.4966	8.2225	8.4966	8.2225	8.4966 (231)
Lighting	15.3049	12.2782	11.0551	8.0995	6.2563	5.1114	5.7072	7.4184	9.6358	12.6427	14.2798	15.7303 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-10.5135	-17.8235	-30.3039	-40.1107	-47.0328	-44.4324	-44.1129	-38.8193	-31.3606	-21.9085	-12.4971	-9.0348 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-1.9317	-4.9317	-11.6305	-20.8679	-28.9016	-28.6057	-28.6546	-22.1822	-14.9388	-7.3951	-2.7904	-1.5346 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	23.6187 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2164.2989 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	100.0410 (230a)
Total electricity for the above, kWh/year	100.0410 (231)
Electricity for lighting (calculated in Appendix L)	123.5196 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-522.3147 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1889.1634 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	23.6187	25.1600	5.9425	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	25.1600	544.5376	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	100.0410	25.1600	25.1703	(249)
Energy for lighting	123.5196	25.1600	31.0775	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.9499	25.1600	-87.5442	
PV Unit electricity exported	-174.3648	5.8100	-10.1306	
Total			-97.6748	(252)
Total energy cost			509.0531	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	23.6187	0.1605	3.7905	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2164.2989	0.1413	305.7097	(264)
Space and water heating			309.5002	(265)
Pumps, fans and electric keep-hot	100.0410	0.1387	13.8769	(267)
Energy for lighting	123.5196	0.1443	17.8277	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.9499	0.1319	-45.8876	
PV Unit electricity exported	-174.3648	0.1230	-21.4411	
Total			-67.3287	(269)
Total CO2, kg/year			273.8761	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year

Space heating - main system 1	23.6187	1.5940	37.6472	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	1.5223	3294.7406	(278)
Space and water heating			3332.3878	(279)
Pumps, fans and electric keep-hot	100.0410	1.5128	151.3420	(281)
Energy for lighting	123.5196	1.5338	189.4585	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.9499	1.4873	-517.4911	
PV Unit electricity exported	-174.3648	0.4513	-78.6883	
Total			-596.1795	(283)
Total Primary energy kWh/year			3077.0088	(286)

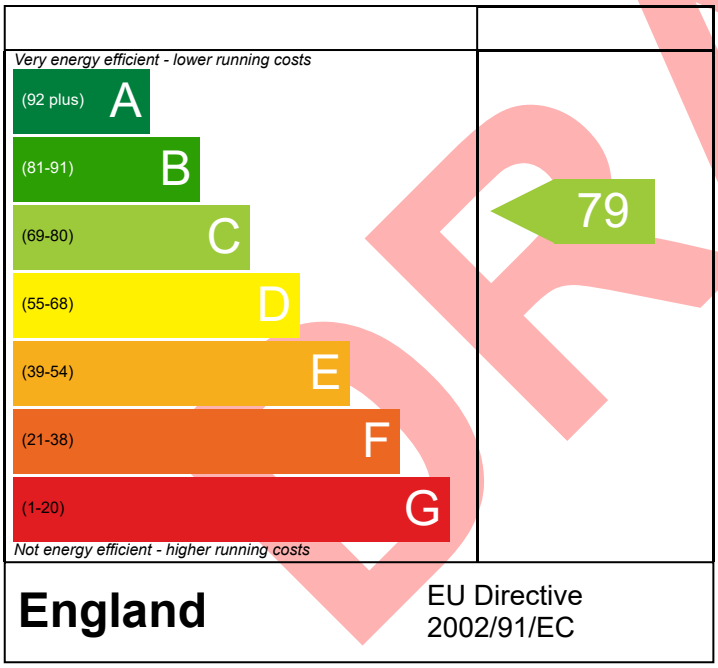
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	48.81 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

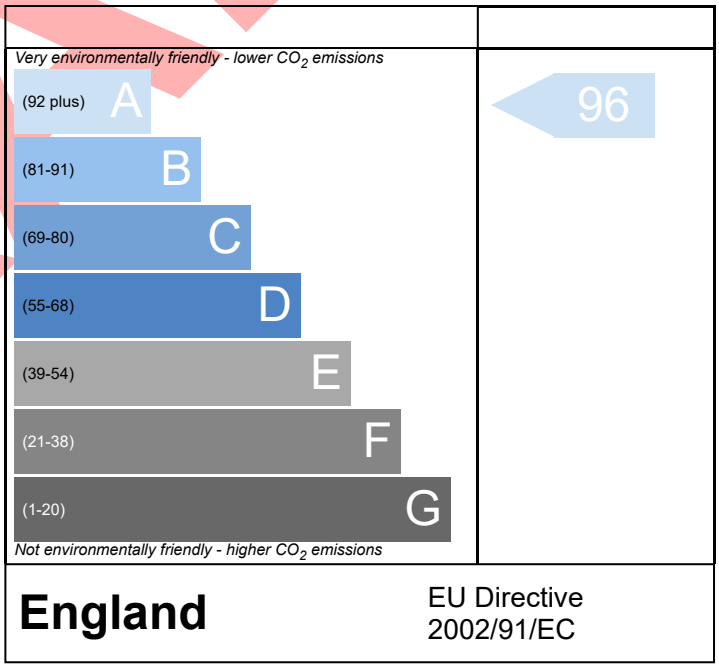
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:23

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	51 m^2
Site Reference	Unit 404 L03_Copy	Plot Reference	Unit 404 L03_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.09 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	5.38 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*60.3 kWh_{PE}/m^2*	
Dwelling primary energy	60.59 kWh_{PE}/m^2	FAIL
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*12.7 kWh/m^2*	
Dwelling fabric energy efficiency	11.8 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	7.91	0.14 **(!)**
Party wall: Party Wall (1)	47.52	0 **(!)**
Party wall: Party Wall (2)	15.79	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SE, Opening Type 1	7.88	South East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.67 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 404 L03_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 404 L03_Copy	**Prop Type Ref**	Unit 404 L03
Property			

SAP Rating	80 C	**DER**	5.38	**TER**	11.09
Environmental	96 A	**% DER < TER**			51.49
CO_2 Emissions (t/year)	0.28	**DFEE**	11.77	**TFEE**	12.71
Compliance Check	See BREL	**% DFEE < TFEE**			7.41
% DPER < TPER	-0.48	**DPER**	60.59	**TPER**	60.30

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.4800	(1b)	x 2.4000	(2b) =	123.5520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.4800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		123.5520	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	15.7900	7.8800	7.9100	0.1400	1.1074	14.0000	110.7400	(29a)
Total net area of external elements Aum(A, m2)			15.7900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.8450			(33)
Party Wall 1			47.5200	0.0000	0.0000	20.0000	950.4000	(32)
Wall to corridor			15.7900	0.0000	0.0000	20.0000	315.8000	(32)
Party Floor 1			51.4800			80.0000	4118.4000	(32d)
Party Ceiling 1			51.4800			80.0000	4118.4000	(32b)
Internal Wall 1			80.1900			9.0000	721.7100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 10335.4500	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	200.7663	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695

E4 Jamb	9.2800	0.0500	0.4640	
E7 Party floor between dwellings (in blocks of flats)	5.8500	0.0700	0.4095	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.4500	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.3670 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 12.2120 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.7513	11.6328	11.5143	10.9218	10.8033	10.2109	10.2109	10.0924	10.4479	10.8033	11.0403	11.2773	(38)
Heat transfer coeff	23.9633	23.8448	23.7264	23.1339	23.0154	22.4229	22.4229	22.3044	22.6599	23.0154	23.2524	23.4894	(39)

Average = Sum(39)m / 12 = 23.1043

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4655	0.4632	0.4609	0.4494	0.4471	0.4356	0.4356	0.4333	0.4402	0.4471	0.4517	0.4563	(40)
HLP (average)												0.4488	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7337 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.2716	72.1705	70.5659	67.4959	65.2303	62.7037	61.2676	62.8600	64.6056	67.3184	70.4543	72.9909	(42a)
Hot water usage for baths	23.0390	22.6968	22.2150	21.3266	20.6614	19.9237	19.5253	20.0037	20.5247	21.3140	22.2207	22.9611	(42b)
Hot water usage for other uses	32.3851	31.2075	30.0298	28.8522	27.6746	26.4969	26.4969	27.6746	28.8522	30.0298	31.2075	32.3851	(42c)

Average daily hot water use (litres/day) 118.3558 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.6957	126.0748	122.8108	117.6747	113.5662	109.1243	107.2898	110.5383	113.9825	118.6622	123.8825	128.3371	(44)
Energy conte	203.8226	179.5288	188.7556	161.0907	152.8819	134.1811	129.7577	136.8695	140.5518	161.0235	176.4934	200.9449	(45)

Energy content (annual) Total = Sum(45)m = 1965.9015

Distribution loss (46)m = 0.15 x (45)m	30.5734	26.9293	28.3133	24.1636	22.9323	20.1272	19.4636	20.5304	21.0828	24.1535	26.4740	30.1417	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)

Total per year (kWh/year) = Sum(64)m = 2212.9335 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	84.5557	74.8537	79.5459	69.8059	67.6179	60.8584	59.9291	62.2937	62.9767	70.3250	74.9273	83.5988	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.7487	15.7643	12.8204	9.7058	7.2552	6.1252	6.6185	8.6029	11.5468	14.6613	17.1120	18.2420	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	225.4877	227.8276	221.9312	209.3786	193.5331	178.6406	168.6914	166.3516	172.2479	184.8006	200.6461	215.5386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	(71)
Water heating gains (Table 5)	113.6501	111.3894	106.9165	96.9526	90.8842	84.5256	80.5498	83.7281	87.4676	94.5228	104.0656	112.3640	(72)
Total internal gains	438.6972	436.7919	423.4788	397.8477	373.4832	351.1020	337.6704	340.4934	353.0731	375.7954	403.6344	427.9553	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(77)

Solar gains	104.6841	178.3157	243.9793	302.3022	338.6036	336.1550	324.0893	297.0068	264.1780	197.0768	125.3874	89.5877	(83)
Total gains	543.3813	615.1076	667.4580	700.1498	712.0869	687.2570	661.7597	637.5001	617.2510	572.8722	529.0217	517.5431	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	119.8063	120.4016	121.0029	124.1019	124.7408	128.0368	128.0368	128.7170	126.6977	124.7408	123.4694	122.2237	
alpha	8.9871	9.0268	9.0669	9.2735	9.3161	9.5358	9.5358	9.5811	9.4465	9.3161	9.2313	9.1482	
util living area													
	0.7234	0.6208	0.5148	0.3998	0.3006	0.2088	0.1491	0.1609	0.2533	0.4178	0.6084	0.7463	(86)
MIT	20.9795	20.9940	20.9988	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9999	20.9961	20.9757	(87)
Th 2	20.5526	20.5547	20.5568	20.5675	20.5696	20.5802	20.5802	20.5824	20.5760	20.5696	20.5653	20.5611	(88)
util rest of house													
	0.7062	0.6042	0.4992	0.3855	0.2867	0.1951	0.1349	0.1463	0.2377	0.4005	0.5899	0.7294	(89)
MIT 2	20.5313	20.5486	20.5557	20.5674	20.5696	20.5802	20.5802	20.5824	20.5760	20.5695	20.5615	20.5356	(90)
Living area fraction										fLA = Living area / (4) =		0.5577	(91)
MIT	20.7812	20.7970	20.8028	20.8086	20.8096	20.8143	20.8143	20.8153	20.8125	20.8095	20.8039	20.7811	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7812	20.7970	20.8028	20.8086	20.8096	20.8143	20.8143	20.8153	20.8125	20.8095	20.8039	20.7811	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7151	0.6132	0.5079	0.3934	0.2944	0.2028	0.1428	0.1545	0.2464	0.4101	0.6001	0.7379	(94)
Useful gains	388.5487	377.2072	338.9911	275.4626	209.6597	139.3436	94.4978	98.4804	152.1033	234.9415	317.4656	381.9023	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	394.9458	379.0622	339.3534	275.4919	209.6614	139.3436	94.4978	98.4804	152.1035	234.9759	318.6483	389.4786	(97)
Space heating kWh													
	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(98a)
Space heating requirement - total per year (kWh/year)												12.8118	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												12.8118	
Space heating per m2											(98c) / (4) =	0.2489	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9614	8.0942	8.9614	8.6723	8.9614	8.6723	8.9614	8.9614	8.6723	8.9614	8.6723	8.9614	(231)
Lighting	15.5353	12.4630	11.2216	8.2214	6.3505	5.1884	5.7931	7.5301	9.7808	12.8330	14.4948	15.9671	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.3128	-19.6230	-32.0667	-40.6524	-47.9480	-46.2189	-45.4896	-40.9865	-33.3753	-24.2196	-14.2561	-10.3736	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4545	-5.6926	-12.5456	-20.8344	-29.1368	-29.9406	-29.5123	-23.8619	-16.2788	-8.5783	-3.3998	-1.8860	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	12.8118	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2212.9335	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	105.5134	(230a)
Total electricity for the above, kWh/year	105.5134	(231)
Electricity for lighting (calculated in Appendix L)	125.3792	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-551.6441	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1904.9938	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	12.8118	16.4900	2.1127	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	16.4900	364.9127	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	105.5134	16.4900	17.3992	(249)
Energy for lighting	125.3792	16.4900	20.6750	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.5224	16.4900	-60.6044	
PV Unit electricity exported	-184.1216	5.5900	-10.2924	
Total			-70.8968	(252)
Total energy cost			334.2027	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2470	(257)
SAP value		79.7857	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	12.8118	0.1616	2.0705	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2212.9335	0.1413	312.5953	(264)
Space and water heating			314.6658	(265)
Pumps, fans and electric keep-hot	105.5134	0.1387	14.6360	(267)
Energy for lighting	125.3792	0.1443	18.0961	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.5224	0.1322	-48.5906	
PV Unit electricity exported	-184.1216	0.1235	-22.7330	
Total			-71.3237	(269)
Total CO2, kg/year			276.0743	(272)
CO2 emissions per m2			5.3600	(273)
EI value			96.1656	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		51.4800 (1b)	x	2.4000 (2b)	=	123.5520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.4800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	123.5520	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	15.7900	7.8800	7.9100	0.1400	1.1074	14.0000	110.7400	(29a)
Total net area of external elements Aum(A, m2)			15.7900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.8450			(33)
Party Wall 1			47.5200	0.0000	0.0000	20.0000	950.4000	(32)
Wall to corridor			15.7900	0.0000	0.0000	20.0000	315.8000	(32)
Party Floor 1			51.4800			80.0000	4118.4000	(32d)
Party Ceiling 1			51.4800			80.0000	4118.4000	(32b)
Internal Wall 1			80.1900			9.0000	721.7100	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 10335.4500 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 200.7663 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.8500	0.0700	0.4095
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.4500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.3670 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 12.2120 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.8698	11.8698	11.6328	10.9218	10.8033	10.3294	10.0924	10.0924	10.5664	11.1588	11.3958	11.2773	(38)
Heat transfer coeff	24.0818	24.0818	23.8448	23.1339	23.0154	22.5414	22.3044	22.3044	22.7784	23.3709	23.6079	23.4894	(39)

Average = Sum(39)m / 12 = 23.2129

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4678	0.4678	0.4632	0.4494	0.4471	0.4379	0.4333	0.4333	0.4425	0.4540	0.4586	0.4563	(40)
HLP (average)												0.4509	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7337 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.2716	72.1705	70.5659	67.4959	65.2303	62.7037	61.2676	62.8600	64.6056	67.3184	70.4543	72.9909	(42a)
Hot water usage for baths	23.0390	22.6968	22.2150	21.3266	20.6614	19.9237	19.5253	20.0037	20.5247	21.3140	22.2207	22.9611	(42b)
Hot water usage for other uses	32.3851	31.2075	30.0298	28.8522	27.6746	26.4969	26.4969	27.6746	28.8522	30.0298	31.2075	32.3851	(42c)

Average daily hot water use (litres/day) 118.3558 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.6957	126.0748	122.8108	117.6747	113.5662	109.1243	107.2898	110.5383	113.9825	118.6622	123.8825	128.3371	(44)
Energy conte	203.8226	179.5288	188.7556	161.0907	152.8819	134.1811	129.7577	136.8695	140.5518	161.0235	176.4934	200.9449	(45)
Energy content (annual)										Total = Sum(45)m =		1965.9015	
Distribution loss (46)m = 0.15 x (45)m	30.5734	26.9293	28.3133	24.1636	22.9323	20.1272	19.4636	20.5304	21.0828	24.1535	26.4740	30.1417	(46)

Water storage loss:

Store volume 143.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)

Temperature factor from Table 2b 0.6000 (49)

Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
										Total per year (kWh/year) = Sum(64)m =		2212.9335	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	84.5557	74.8537	79.5459	69.8059	67.6179	60.8584	59.9291	62.2937	62.9767	70.3250	74.9273	83.5988	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	17.7487	15.7643	12.8204	9.7058	7.2552	6.1252	6.6185	8.6029	11.5468	14.6613	17.1120	18.2420	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	225.4877	227.8276	221.9312	209.3786	193.5331	178.6406	168.6914	166.3516	172.2479	184.8006	200.6461	215.5386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	(71)
Water heating gains (Table 5)													
	113.6501	111.3894	106.9165	96.9526	90.8842	84.5256	80.5498	83.7281	87.4676	94.5228	104.0656	112.3640	(72)
Total internal gains													
	438.6972	436.7919	423.4788	397.8477	373.4832	351.1020	337.6704	340.4934	353.0731	375.7954	403.6344	427.9553	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(77)

Solar gains	95.2051	173.0844	247.4999	322.5774	357.6553	345.0938	336.8383	300.1802	265.5901	190.1488	117.1921	83.3220	(83)
Total gains	533.9023	609.8763	670.9786	720.4250	731.1385	696.1958	674.5087	640.6735	618.6632	565.9442	520.8265	511.2773	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	119.2167	119.2167	120.4016	124.1019	124.7408	127.3637	128.7170	128.7170	126.0386	122.8434	121.6103	122.2237	
alpha	8.9478	8.9478	9.0268	9.2735	9.3161	9.4909	9.5811	9.5811	9.4026	9.1896	9.1074	9.1482	
util living area													
	0.7526	0.6539	0.5462	0.4206	0.3242	0.2525	0.2017	0.2158	0.3019	0.4664	0.6480	0.7727	(86)
MIT	20.9712	20.9903	20.9979	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9996	20.9929	20.9672	(87)
Th 2	20.5504	20.5504	20.5547	20.5675	20.5696	20.5781	20.5824	20.5824	20.5738	20.5632	20.5589	20.5611	(88)
util rest of house													
	0.7357	0.6373	0.5306	0.4067	0.3107	0.2389	0.1879	0.2013	0.2862	0.4484	0.6291	0.7564	(89)
MIT 2	20.5201	20.5405	20.5526	20.5673	20.5696	20.5781	20.5824	20.5824	20.5738	20.5629	20.5519	20.5263	(90)
Living area fraction										fLA = Living area / (4) =		0.5577	(91)
MIT	20.7716	20.7914	20.8010	20.8085	20.8096	20.8134	20.8153	20.8153	20.8115	20.8064	20.7978	20.7722	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7716	20.7914	20.8010	20.8085	20.8096	20.8134	20.8153	20.8153	20.8115	20.8064	20.7978	20.7722	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7441	0.6462	0.5392	0.4144	0.3182	0.2465	0.1956	0.2094	0.2950	0.4585	0.6394	0.7643	(94)
Useful gains	397.2723	394.1170	361.8210	298.5746	232.6729	171.6165	131.9370	134.1674	182.4879	259.4584	332.9973	390.7730	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	406.3003	397.1421	362.4645	298.6242	232.6766	171.6167	131.9370	134.1674	182.4893	259.5673	335.1804	401.0157	(97)
Space heating kWh													
	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205	(98a)
Space heating requirement - total per year (kWh/year)												18.5404	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												18.5404	
Space heating per m2										(98c) / (4) =		0.3601	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9614	8.0942	8.9614	8.6723	8.9614	8.6723	8.9614	8.9614	8.6723	8.9614	8.6723	8.9614	(231)

Lighting	15.5353	12.4630	11.2216	8.2214	6.3505	5.1884	5.7931	7.5301	9.7808	12.8330	14.4948	15.9671 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-11.1496	-18.8721	-32.0603	-42.3899	-49.6609	-46.9012	-46.5595	-40.9992	-33.1527	-23.1943	-13.2464	-9.5840 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.0858	-5.3278	-12.5367	-22.4603	-31.0947	-30.7742	-30.8282	-23.8754	-16.0865	-7.9699	-3.0116	-1.6564 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	18.5404 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2212.9335 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	105.5134 (230a)
Total electricity for the above, kWh/year	105.5134 (231)
Electricity for lighting (calculated in Appendix L)	125.3792 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-555.4776 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1906.8888 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	18.5404	25.1600	4.6648	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	25.1600	556.7741	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	105.5134	25.1600	26.5472	(249)
Energy for lighting	125.3792	25.1600	31.5454	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.7700	25.1600	-92.5309	
PV Unit electricity exported	-187.7076	5.8100	-10.9058	
Total			-103.4367	(252)
Total energy cost			516.0946	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	18.5404	0.1612	2.9893	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2212.9335	0.1413	312.5953	(264)
Space and water heating			315.5847	(265)
Pumps, fans and electric keep-hot	105.5134	0.1387	14.6360	(267)
Energy for lighting	125.3792	0.1443	18.0961	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.7700	0.1319	-48.5087	
PV Unit electricity exported	-187.7076	0.1230	-23.0860	
Total			-71.5947	(269)
Total CO2, kg/year			276.7220	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	18.5404	1.5966	29.6024	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	1.5223	3368.8373	(278)
Space and water heating			3398.4396	(279)
Pumps, fans and electric keep-hot	105.5134	1.5128	159.6207	(281)
Energy for lighting	125.3792	1.5338	192.3107	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.7700	1.4873	-546.9961	
PV Unit electricity exported	-187.7076	0.4514	-84.7250	
Total			-631.7212	(283)
Total Primary energy kWh/year			3118.6499	(286)

SAP 10 EPC IMPROVEMENTS

Unit 404 L03_Copy

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 80
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£620	£620	£0
Space heating	£31	£31	£0
Water heating	£557	£557	£0
Lighting	£32	£32	£0
Generated (PV)	-£103	-£103	£0
Total cost of fuels	£517	£517	£0
Total cost of uses	£517	£517	£0
Delivered energy	37 kWh/m²	37 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	61 kWh/m²	61 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.4800 (1b)	x	2.4000 (2b)	=	123.5520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.4800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	123.5520	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	15.7900	7.8800	7.9100	0.1400	1.1074	14.0000	110.7400	(29a)
Total net area of external elements Aum(A, m2)			15.7900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	10.8450			(33)
Party Wall 1			47.5200	0.0000	0.0000	20.0000	950.4000	(32)
Wall to corridor			15.7900	0.0000	0.0000	20.0000	315.8000	(32)
Party Floor 1			51.4800			80.0000	4118.4000	(32d)
Party Ceiling 1			51.4800			80.0000	4118.4000	(32b)
Internal Wall 1			80.1900			9.0000	721.7100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10335.4500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		200.7663 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.8500	0.0700	0.4095
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.4500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.3670 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	12.2120 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.7513	11.6328	11.5143	10.9218	10.8033	10.2109	10.2109	10.0924	10.4479	10.8033	11.0403	11.2773	(38)
Heat transfer coeff	23.9633	23.8448	23.7264	23.1339	23.0154	22.4229	22.4229	22.3044	22.6599	23.0154	23.2524	23.4894	(39)
Average = Sum(39)m / 12 =												23.1043	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4655	0.4632	0.4609	0.4494	0.4471	0.4356	0.4356	0.4333	0.4402	0.4471	0.4517	0.4563	(40)
HLP (average)												0.4488	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7337	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.2716	72.1705	70.5659	67.4959	65.2303	62.7037	61.2676	62.8600	64.6056	67.3184	70.4543	72.9909	(42a)

Hot water usage for baths

23.0390	22.6968	22.2150	21.3266	20.6614	19.9237	19.5253	20.0037	20.5247	21.3140	22.2207	22.9611	(42b)

Hot water usage for other uses

32.3851	31.2075	30.0298	28.8522	27.6746	26.4969	26.4969	27.6746	28.8522	30.0298	31.2075	32.3851	(42c)

Average daily hot water use (litres/day)	118.3558	(43)

Daily hot water use

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
128.6957	126.0748	122.8108	117.6747	113.5662	109.1243	107.2898	110.5383	113.9825	118.6622	123.8825	128.3371	(44)
Energy conte 203.8226	179.5288	188.7556	161.0907	152.8819	134.1811	129.7577	136.8695	140.5518	161.0235	176.4934	200.9449	(45)

Energy content (annual)	Total = Sum(45)m =	1965.9015

Distribution loss (46)m = 0.15 x (45)m

30.5734	26.9293	28.3133	24.1636	22.9323	20.1272	19.4636	20.5304	21.0828	24.1535	26.4740	30.1417	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)

Total per year (kWh/year) = Sum(64)m =	2212.9335	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000	(64a)

Heat gains from water heating, kWh/month

84.5557	74.8537	79.5459	69.8059	67.6179	60.8584	59.9291	62.2937	62.9767	70.3250	74.9273	83.5988	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.7487	15.7643	12.8204	9.7058	7.2552	6.1252	6.6185	8.6029	11.5468	14.6613	17.1120	18.2420	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	225.4877	227.8276	221.9312	209.3786	193.5331	178.6406	168.6914	166.3516	172.2479	184.8006	200.6461	215.5386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	(71)
Water heating gains (Table 5)	113.6501	111.3894	106.9165	96.9526	90.8842	84.5256	80.5498	83.7281	87.4676	94.5228	104.0656	112.3640	(72)
Total internal gains	438.6972	436.7919	423.4788	397.8477	373.4832	351.1020	337.6704	340.4934	353.0731	375.7954	403.6344	427.9553	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(77)

Solar gains	104.6841	178.3157	243.9793	302.3022	338.6036	336.1550	324.0893	297.0068	264.1780	197.0768	125.3874	89.5877 (83)
Total gains	543.3813	615.1076	667.4580	700.1498	712.0869	687.2570	661.7597	637.5001	617.2510	572.8722	529.0217	517.5431 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	119.8063	120.4016	121.0029	124.1019	124.7408	128.0368	128.0368	128.7170	126.6977	124.7408	123.4694	122.2237	
alpha	8.9871	9.0268	9.0669	9.2735	9.3161	9.5358	9.5358	9.5811	9.4465	9.3161	9.2313	9.1482	
util living area	0.7234	0.6208	0.5148	0.3998	0.3006	0.2088	0.1491	0.1609	0.2533	0.4178	0.6084	0.7463	(86)
MIT	20.9795	20.9940	20.9988	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9999	20.9961	20.9757	(87)
Th 2	20.5526	20.5547	20.5568	20.5675	20.5696	20.5802	20.5802	20.5824	20.5760	20.5696	20.5653	20.5611	(88)
util rest of house	0.7062	0.6042	0.4992	0.3855	0.2867	0.1951	0.1349	0.1463	0.2377	0.4005	0.5899	0.7294	(89)
MIT 2	20.5313	20.5486	20.5557	20.5674	20.5696	20.5802	20.5802	20.5824	20.5760	20.5695	20.5615	20.5356	(90)
Living area fraction									fLA = Living area / (4) =			0.5577	(91)
MIT	20.7812	20.7970	20.8028	20.8086	20.8096	20.8143	20.8143	20.8153	20.8125	20.8095	20.8039	20.7811	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7812	20.7970	20.8028	20.8086	20.8096	20.8143	20.8143	20.8153	20.8125	20.8095	20.8039	20.7811	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7151	0.6132	0.5079	0.3934	0.2944	0.2028	0.1428	0.1545	0.2464	0.4101	0.6001	0.7379	(94)
Useful gains	388.5487	377.2072	338.9911	275.4626	209.6597	139.3436	94.4978	98.4804	152.1033	234.9415	317.4656	381.9023	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	394.9458	379.0622	339.3534	275.4919	209.6614	139.3436	94.4978	98.4804	152.1035	234.9759	318.6483	389.4786	(97)
Space heating kWh	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(98a)
Space heating requirement - total per year (kWh/year)												12.8118	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												12.8118	
Space heating per m2											(98c) / (4) =	0.2489	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9614	8.0942	8.9614	8.6723	8.9614	8.6723	8.9614	8.9614	8.6723	8.9614	8.6723	8.9614	(231)
Lighting	15.5353	12.4630	11.2216	8.2214	6.3505	5.1884	5.7931	7.5301	9.7808	12.8330	14.4948	15.9671	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.3128	-19.6230	-32.0667	-40.6524	-47.9480	-46.2189	-45.4896	-40.9865	-33.3753	-24.2196	-14.2561	-10.3736	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4545	-5.6926	-12.5456	-20.8344	-29.1368	-29.9406	-29.5123	-23.8619	-16.2788	-8.5783	-3.3998	-1.8860	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												12.8118	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2212.9335	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	105.5134	(230a)
Total electricity for the above, kWh/year	105.5134	(231)
Electricity for lighting (calculated in Appendix L)	125.3792	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-551.6441	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1904.9938	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	12.8118	16.4900	2.1127	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	16.4900	364.9127	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	105.5134	16.4900	17.3992	(249)
Energy for lighting	125.3792	16.4900	20.6750	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.5224	16.4900	-60.6044	
PV Unit electricity exported	-184.1216	5.5900	-10.2924	
Total			-70.8968	(252)
Total energy cost			334.2027	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2470	(257)
SAP value	79.7857	
SAP rating (Section 12)	80	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	12.8118	0.1616	2.0705	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2212.9335	0.1413	312.5953	(264)
Space and water heating			314.6658	(265)
Pumps, fans and electric keep-hot	105.5134	0.1387	14.6360	(267)
Energy for lighting	125.3792	0.1443	18.0961	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.5224	0.1322	-48.5906	
PV Unit electricity exported	-184.1216	0.1235	-22.7330	
Total			-71.3237	(269)
Total CO2, kg/year			276.0743	(272)
CO2 emissions per m2			5.3600	(273)
EI value			96.1656	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.4800	(1b)	x 2.4000	(2b) =	123.5520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 51.4800						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		123.5520	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 = 0.0000	(6a)
Number of open flues	0 * 20 = 0.0000	(6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	15.7900	7.8800	7.9100	0.1400	1.1074	14.0000	110.7400	(29a)
Total net area of external elements Aum(A, m2)			15.7900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	10.8450			(33)
Party Wall 1			47.5200	0.0000	0.0000	20.0000	950.4000	(32)
Wall to corridor			15.7900	0.0000	0.0000	20.0000	315.8000	(32)
Party Floor 1			51.4800			80.0000	4118.4000	(32d)
Party Ceiling 1			51.4800			80.0000	4118.4000	(32b)
Internal Wall 1			80.1900			9.0000	721.7100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10335.4500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		200.7663 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.8500	0.0700	0.4095
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.4500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.3670 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	12.2120 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.8698	11.8698	11.6328	10.9218	10.8033	10.3294	10.0924	10.0924	10.5664	11.1588	11.3958	11.2773	(38)
Heat transfer coeff	24.0818	24.0818	23.8448	23.1339	23.0154	22.5414	22.3044	22.3044	22.7784	23.3709	23.6079	23.4894	(39)
Average = Sum(39)m / 12 =												23.2129	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4678	0.4678	0.4632	0.4494	0.4471	0.4379	0.4333	0.4333	0.4425	0.4540	0.4586	0.4563	(40)
HLP (average)												0.4509	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.7337 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.2716	72.1705	70.5659	67.4959	65.2303	62.7037	61.2676	62.8600	64.6056	67.3184	70.4543	72.9909	(42a)

Hot water usage for baths

23.0390	22.6968	22.2150	21.3266	20.6614	19.9237	19.5253	20.0037	20.5247	21.3140	22.2207	22.9611	(42b)

Hot water usage for other uses

32.3851	31.2075	30.0298	28.8522	27.6746	26.4969	26.4969	27.6746	28.8522	30.0298	31.2075	32.3851	(42c)

Average daily hot water use (litres/day)		118.3558 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.6957	126.0748	122.8108	117.6747	113.5662	109.1243	107.2898	110.5383	113.9825	118.6622	123.8825	128.3371	(44)
Energy conte	203.8226	179.5288	188.7556	161.0907	152.8819	134.1811	129.7577	136.8695	140.5518	161.0235	176.4934	200.9449	(45)
Energy content (annual)										Total = Sum(45)m =		1965.9015	

Distribution loss (46)m = 0.15 x (45)m

30.5734	26.9293	28.3133	24.1636	22.9323	20.1272	19.4636	20.5304	21.0828	24.1535	26.4740	30.1417	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
										Total per year (kWh/year) = Sum(64)m =		2212.9335	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	84.5557	74.8537	79.5459	69.8059	67.6179	60.8584	59.9291	62.2937	62.9767	70.3250	74.9273	83.5988	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.7487	15.7643	12.8204	9.7058	7.2552	6.1252	6.6185	8.6029	11.5468	14.6613	17.1120	18.2420	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	225.4877	227.8276	221.9312	209.3786	193.5331	178.6406	168.6914	166.3516	172.2479	184.8006	200.6461	215.5386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	(71)
Water heating gains (Table 5)	113.6501	111.3894	106.9165	96.9526	90.8842	84.5256	80.5498	83.7281	87.4676	94.5228	104.0656	112.3640	(72)
Total internal gains	438.6972	436.7919	423.4788	397.8477	373.4832	351.1020	337.6704	340.4934	353.0731	375.7954	403.6344	427.9553	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(77)

Solar gains	95.2051	173.0844	247.4999	322.5774	357.6553	345.0938	336.8383	300.1802	265.5901	190.1488	117.1921	83.3220	(83)
Total gains	533.9023	609.8763	670.9786	720.4250	731.1385	696.1958	674.5087	640.6735	618.6632	565.9442	520.8265	511.2773	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	119.2167	119.2167	120.4016	124.1019	124.7408	127.3637	128.7170	128.7170	126.0386	122.8434	121.6103	122.2237	
alpha	8.9478	8.9478	9.0268	9.2735	9.3161	9.4909	9.5811	9.5811	9.4026	9.1896	9.1074	9.1482	
util living area	0.7526	0.6539	0.5462	0.4206	0.3242	0.2525	0.2017	0.2158	0.3019	0.4664	0.6480	0.7727	(86)
MIT	20.9712	20.9903	20.9979	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9996	20.9929	20.9672	(87)
Th 2	20.5504	20.5504	20.5547	20.5675	20.5696	20.5781	20.5824	20.5824	20.5738	20.5632	20.5589	20.5611	(88)
util rest of house	0.7357	0.6373	0.5306	0.4067	0.3107	0.2389	0.1879	0.2013	0.2862	0.4484	0.6291	0.7564	(89)
MIT 2	20.5201	20.5405	20.5526	20.5673	20.5696	20.5781	20.5824	20.5824	20.5738	20.5629	20.5519	20.5263	(90)
Living area fraction										fLA = Living area / (4) =		0.5577	(91)
MIT	20.7716	20.7914	20.8010	20.8085	20.8096	20.8134	20.8153	20.8153	20.8115	20.8064	20.7978	20.7722	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7716	20.7914	20.8010	20.8085	20.8096	20.8134	20.8153	20.8153	20.8115	20.8064	20.7978	20.7722	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7441	0.6462	0.5392	0.4144	0.3182	0.2465	0.1956	0.2094	0.2950	0.4585	0.6394	0.7643	(94)
Useful gains	397.2723	394.1170	361.8210	298.5746	232.6729	171.6165	131.9370	134.1674	182.4879	259.4584	332.9973	390.7730	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	406.3003	397.1421	362.4645	298.6242	232.6766	171.6167	131.9370	134.1674	182.4893	259.5673	335.1804	401.0157	(97)
Space heating kWh	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205	(98a)
Space heating requirement - total per year (kWh/year)												18.5404	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												18.5404	
Space heating per m2											(98c) / (4) =	0.3601	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													

	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	8.9614	8.0942	8.9614	8.6723	8.9614	8.6723	8.9614	8.9614	8.6723	8.9614	8.6723	8.9614 (231)
Lighting	15.5353	12.4630	11.2216	8.2214	6.3505	5.1884	5.7931	7.5301	9.7808	12.8330	14.4948	15.9671 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-11.1496	-18.8721	-32.0603	-42.3899	-49.6609	-46.9012	-46.5595	-40.9992	-33.1527	-23.1943	-13.2464	-9.5840 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.0858	-5.3278	-12.5367	-22.4603	-31.0947	-30.7742	-30.8282	-23.8754	-16.0865	-7.9699	-3.0116	-1.6564 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	18.5404 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2212.9335 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	105.5134 (230a)
Total electricity for the above, kWh/year	105.5134 (231)
Electricity for lighting (calculated in Appendix L)	125.3792 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-555.4776 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1906.8888 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	18.5404	25.1600	4.6648	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	25.1600	556.7741	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	105.5134	25.1600	26.5472	(249)
Energy for lighting	125.3792	25.1600	31.5454	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.7700	25.1600	-92.5309	
PV Unit electricity exported	-187.7076	5.8100	-10.9058	
Total			-103.4367	(252)
Total energy cost			516.0946	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	18.5404	0.1612	2.9893	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2212.9335	0.1413	312.5953	(264)
Space and water heating			315.5847	(265)
Pumps, fans and electric keep-hot	105.5134	0.1387	14.6360	(267)
Energy for lighting	125.3792	0.1443	18.0961	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.7700	0.1319	-48.5087	
PV Unit electricity exported	-187.7076	0.1230	-23.0860	
Total			-71.5947	(269)
Total CO2, kg/year			276.7220	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	18.5404	1.5966	29.6024	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	1.5223	3368.8373	(278)
Space and water heating			3398.4396	(279)

Pumps, fans and electric keep-hot	105.5134	1.5128	159.6207 (281)
Energy for lighting	125.3792	1.5338	192.3107 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-367.7700	1.4873	-546.9961
PV Unit electricity exported	-187.7076	0.4514	-84.7250
Total			-631.7212 (283)
Total Primary energy kWh/year			3118.6499 (286)

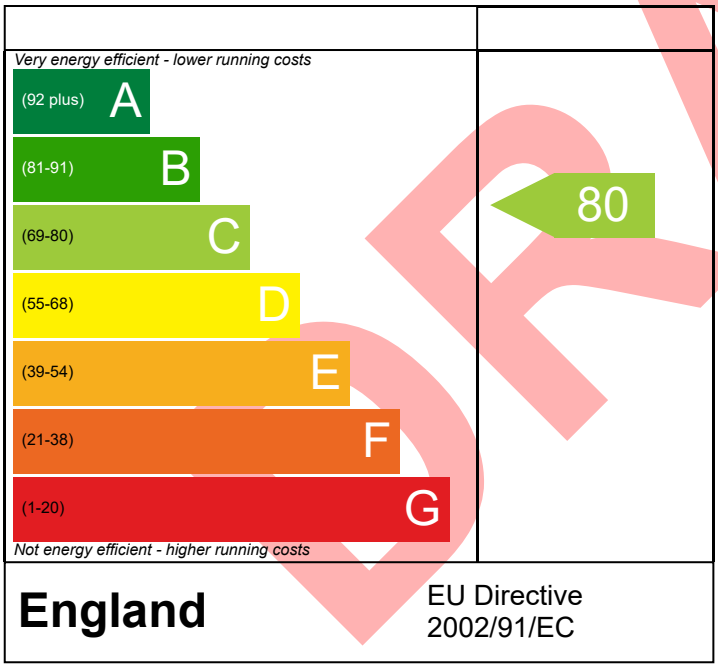
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	51.48 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

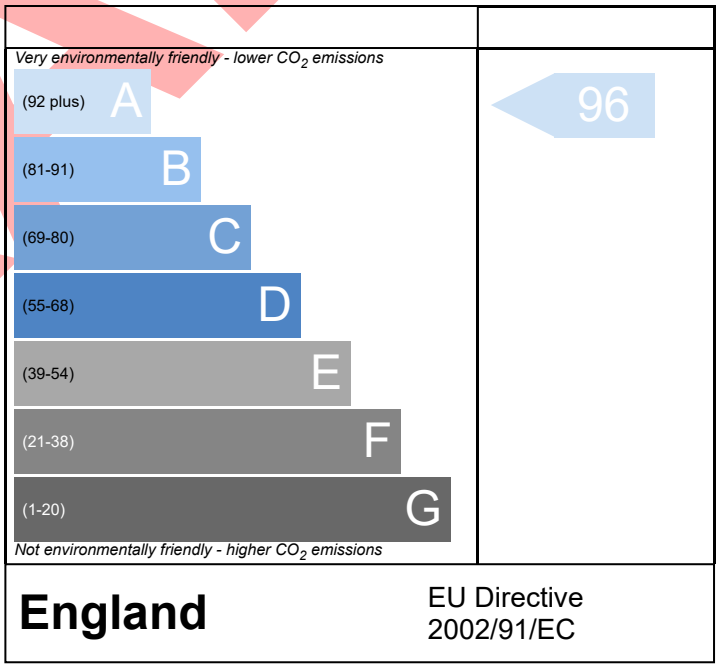
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:23

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	66 m^2
Site Reference	Unit 405 L03_Copy	Plot Reference	Unit 405 L03_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*12.09 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	5.9 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*65.26 kWh_{PE}/m^2*	
Dwelling primary energy	65.22 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*25.4 kWh/m^2*	
Dwelling fabric energy efficiency	26.2 kWh/m^2	FAIL

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	21.88	0.14 **(!)**
Party wall: Party Wall (1)	30.24	0 **(!)**
Party wall: Party Wall (2)	14.18	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	7.88	North East	0.83	1.3
N, Opening Type 1	3.59	North	0.83	1.3
NW, Opening Type 1	7.88	North West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.85 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 405 L03_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 405 L03_Copy	**Prop Type Ref**	Unit 405 L03
Property			

SAP Rating	77 C	**DER**	5.90	**TER**	12.09
Environmental	95 A	**% DER < TER**			51.20
CO_2 Emissions (t/year)	0.39	**DFEE**	26.20	**TFEE**	25.40
Compliance Check	See BREL	**% DFEE < TFEE**			-3.16
% DPER < TPER	0.06	**DPER**	65.22	**TPER**	65.26

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.6000 (1b)	x	2.4000 (2b)	=	157.4400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	157.4400	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.3500	1.2357	23.9116			(27)
External Wall 1	41.2300	19.3500	21.8800	0.1400	3.0632	14.0000	306.3200	(29a)
Total net area of external elements Aum(A, m2)			41.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.9748			(33)
Party Wall 1			30.2400	0.0000	0.0000	20.0000	604.8000	(32)
Wall to corridor			14.1800	0.0000	0.0000	20.0000	283.6000	(32)
Party Floor 1			65.6000			80.0000	5248.0000	(32d)
Party Ceiling 1			65.6000			80.0000	5248.0000	(32b)
Internal Wall 1			114.4800			9.0000	1030.3200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12721.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		193.9183 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240

E4 Jamb	23.2000	0.0500	1.1600	
E7 Party floor between dwellings (in blocks of flats)	15.2700	0.0700	1.0689	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.4500	0.0000	0.0000	
E16 Corner (normal)	5.4000	0.0900	0.4860	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.4629 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 30.4377 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.7197	15.5541	15.3885	14.5604	14.3948	13.5668	13.5668	13.4012	13.8980	14.3948	14.7261	15.0573	(38)
Heat transfer coeff	46.1574	45.9918	45.8262	44.9981	44.8325	44.0045	44.0045	43.8389	44.3357	44.8325	45.1637	45.4950	(39)
Average = Sum(39)m / 12 =												44.9567	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7036	0.7011	0.6986	0.6859	0.6834	0.6708	0.6708	0.6683	0.6758	0.6834	0.6885	0.6935	(40)
HLP (average)												0.6853	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1348 (42)
Hot water usage for mixer showers

82.5173	81.2772	79.4702	76.0128	73.4613	70.6159	68.9985	70.7919	72.7577	75.8128	79.3445	82.2011	(42a)

Hot water usage for baths

25.9306	25.5455	25.0032	24.0033	23.2545	22.4243	21.9759	22.5144	23.1007	23.9891	25.0096	25.8429	(42b)

Hot water usage for other uses

36.4921	35.1651	33.8381	32.5112	31.1842	29.8572	29.8572	31.1842	32.5112	33.8381	35.1651	36.4921	(42c)

Average daily hot water use (litres/day) 133.2946 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.9400	141.9879	138.3115	132.5272	127.9000	122.8974	120.8316	124.4905	128.3696	133.6401	139.5193	144.5362	(44)
Energy conte	229.5496	202.1888	212.5797	181.4231	172.1780	151.1167	146.1353	154.1452	158.2926	181.3483	198.7708	226.3088	(45)
Energy content (annual)										Total = Sum(45)m =		2214.0368	

Distribution loss (46)m = 0.15 x (45)m

34.4324	30.3283	31.8870	27.2135	25.8267	22.6675	21.9203	23.1218	23.7439	27.2023	29.8156	33.9463	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)

Total per year (kWh/year) = Sum(64)m = 2461.0688 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

93.1099	82.3881	87.4674	76.5664	74.0338	66.4895	65.3746	68.0379	68.8755	77.0830	82.3345	92.0323	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.5047	19.1002	15.5334	11.7598	8.7906	7.4214	8.0190	10.4234	13.9903	17.7639	20.7331	22.1023	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	278.8333	281.7267	274.4354	258.9131	239.3189	220.9031	208.6002	205.7068	212.9981	228.5205	248.1147	266.5304	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(70)
Losses e.g. evaporation (negative values) (Table 5)	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	(71)
Water heating gains (Table 5)	125.1477	122.6013	117.5637	106.3422	99.5078	92.3465	87.8691	91.4488	95.6604	103.6061	114.3535	123.6993	(72)
Total internal gains	518.1243	516.0669	500.1711	469.6536	440.2559	413.3096	397.1270	400.2177	415.2875	442.5292	475.8399	504.9707	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5900	10.6334	0.6300	0.8270	0.7700	13.7831	(74)
Northeast	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(75)
Northwest	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(81)

Solar gains 77.9864	157.0279	280.2162	458.5828	616.6334	657.8250	615.1898	490.0648	340.7231	191.0654	97.7876	63.9219	(83)
Total gains 596.1107	673.0949	780.3873	928.2365	1056.8893	1071.1345	1012.3168	890.2825	756.0106	633.5945	573.6275	568.8927	(84)

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7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
tau	76.5559	76.8316	77.1093	78.5282	78.8183	80.3014	80.3014	80.6047	79.7015	78.8183	78.2402	77.6706	
alpha	6.1037	6.1221	6.1406	6.2352	6.2546	6.3534	6.3534	6.3736	6.3134	6.2546	6.2160	6.1780	
util living area	0.9437	0.8971	0.7825	0.5777	0.3938	0.2629	0.1913	0.2265	0.4038	0.7039	0.8971	0.9531	(86)
MIT	20.5409	20.6986	20.8811	20.9817	20.9983	20.9999	21.0000	21.0000	20.9987	20.9551	20.7496	20.5092	(87)
Th 2	20.3376	20.3399	20.3421	20.3533	20.3555	20.3667	20.3667	20.3689	20.3622	20.3555	20.3510	20.3466	(88)
util rest of house	0.9339	0.8815	0.7577	0.5488	0.3667	0.2369	0.1637	0.1954	0.3668	0.6677	0.8790	0.9447	(89)
MIT 2	19.8185	20.0094	20.2201	20.3364	20.3542	20.3666	20.3667	20.3689	20.3613	20.3148	20.0834	19.7875	(90)
Living area fraction										fLA = Living area / (4) =		0.4663	(91)
MIT	20.1554	20.3308	20.5284	20.6373	20.6546	20.6619	20.6620	20.6632	20.6585	20.6134	20.3941	20.1241	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1554	20.3308	20.5284	20.6373	20.6546	20.6619	20.6620	20.6632	20.6585	20.6134	20.3941	20.1241	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9309	0.8813	0.7649	0.5616	0.3793	0.2490	0.1766	0.2099	0.3841	0.6825	0.8803	0.9414	(94)
Useful gains	554.9067	593.1911	596.9001	521.2762	400.8703	266.7233	178.7442	186.8865	290.3468	432.4035	504.9500	535.5811	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	731.8424	709.6904	642.8668	528.1577	401.4553	266.7525	178.7466	186.8936	290.7766	448.9253	600.4104	724.4643	(97)
Space heating kWh	131.6402	78.2875	34.1992	4.9547	0.4352	0.0000	0.0000	0.0000	0.0000	12.2922	68.7315	140.5291	(98a)
Space heating requirement - total per year (kWh/year)												471.0696	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	131.6402	78.2875	34.1992	4.9547	0.4352	0.0000	0.0000	0.0000	0.0000	12.2922	68.7315	140.5291	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												471.0696	
Space heating per m2											(98c) / (4) =	7.1809	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	131.6402	78.2875	34.1992	4.9547	0.4352	0.0000	0.0000	0.0000	0.0000	12.2922	68.7315	140.5291	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	131.6402	78.2875	34.1992	4.9547	0.4352	0.0000	0.0000	0.0000	0.0000	12.2922	68.7315	140.5291	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	12.1045	10.9331	12.1045	11.7141	12.1045	11.7141	12.1045	12.1045	11.7141	12.1045	11.7141	12.1045	(231)
Lighting	18.8229	15.1004	13.5963	9.9612	7.6943	6.2863	7.0190	9.1236	11.8506	15.5487	17.5622	19.3460	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.8151	-25.1332	-40.5864	-50.8024	-59.6183	-57.3843	-56.4723	-50.9617	-41.6122	-30.4646	-18.2004	-13.3279	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.9195	-6.9836	-16.0113	-27.2032	-38.1758	-39.2360	-38.6794	-31.3088	-21.3818	-11.1448	-4.1988	-2.2253	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	471.0696	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2461.0688	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	142.5210	(230a)
Total electricity for the above, kWh/year	142.5210	(231)
Electricity for lighting (calculated in Appendix L)	151.9116	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-699.8470	(233)
Wind generation	0.0000	(234)

Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2526.7240	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	471.0696	16.4900	77.6794	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	16.4900	405.8302	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	142.5210	16.4900	23.5017	(249)
Energy for lighting	151.9116	16.4900	25.0502	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.3787	16.4900	-75.9165	
PV Unit electricity exported	-239.4682	5.5900	-13.3863	
Total			-89.3027	(252)
Total energy cost			442.7588	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.4412	(257)
SAP value	76.6387	
SAP rating (Section 12)	77	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	471.0696	0.1591	74.9382	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2461.0688	0.1413	347.7259	(264)
Space and water heating			422.6642	(265)
Pumps, fans and electric keep-hot	142.5210	0.1387	19.7694	(267)
Energy for lighting	151.9116	0.1443	21.9255	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.3787	0.1324	-60.9461	
PV Unit electricity exported	-239.4682	0.1230	-29.4551	
Total			-90.4011	(269)
Total CO2, kg/year			373.9580	(272)
CO2 emissions per m2			5.7000	(273)
EI value			95.4692	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.6000 (1b)	x	2.4000 (2b)	=	157.4400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	157.4400	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.3500	1.2357	23.9116			(27)
External Wall 1	41.2300	19.3500	21.8800	0.1400	3.0632	14.0000	306.3200	(29a)
Total net area of external elements Aum(A, m2)			41.2300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.9748			(33)
Party Wall 1			30.2400	0.0000	0.0000	20.0000	604.8000	(32)
Wall to corridor			14.1800	0.0000	0.0000	20.0000	283.6000	(32)
Party Floor 1			65.6000			80.0000	5248.0000	(32d)
Party Ceiling 1			65.6000			80.0000	5248.0000	(32b)
Internal Wall 1			114.4800			9.0000	1030.3200	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12721.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 193.9183 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	15.2700	0.0700	1.0689
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.4500	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.4629 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 30.4377 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.8853	15.8853	15.5541	14.5604	14.3948	13.7324	13.4012	13.4012	14.0636	14.8917	15.2229	15.0573	(38)
Heat transfer coeff	46.3230	46.3230	45.9918	44.9981	44.8325	44.1701	43.8389	43.8389	44.5013	45.3294	45.6606	45.4950	(39)

Average = Sum(39)m / 12 = 45.1085

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7061	0.7061	0.7011	0.6859	0.6834	0.6733	0.6683	0.6683	0.6784	0.6910	0.6960	0.6935	(40)
HLP (average)												0.6876	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1348 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	82.5173	81.2772	79.4702	76.0128	73.4613	70.6159	68.9985	70.7919	72.7577	75.8128	79.3445	82.2011	(42a)
Hot water usage for baths	25.9306	25.5455	25.0032	24.0033	23.2545	22.4243	21.9759	22.5144	23.1007	23.9891	25.0096	25.8429	(42b)
Hot water usage for other uses	36.4921	35.1651	33.8381	32.5112	31.1842	29.8572	29.8572	31.1842	32.5112	33.8381	35.1651	36.4921	(42c)

Average daily hot water use (litres/day) 133.2946 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.9400	141.9879	138.3115	132.5272	127.9000	122.8974	120.8316	124.4905	128.3696	133.6401	139.5193	144.5362	(44)
Energy conte	229.5496	202.1888	212.5797	181.4231	172.1780	151.1167	146.1353	154.1452	158.2926	181.3483	198.7708	226.3088	(45)

Energy content (annual) Total = Sum(45)m = 2214.0368
Distribution loss (46)m = 0.15 x (45)m

	34.4324	30.3283	31.8870	27.2135	25.8267	22.6675	21.9203	23.1218	23.7439	27.2023	29.8156	33.9463	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)

Total per year (kWh/year) = Sum(64)m = 2461.0688 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

	93.1099	82.3881	87.4674	76.5664	74.0338	66.4895	65.3746	68.0379	68.8755	77.0830	82.3345	92.0323	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	21.5047	19.1002	15.5334	11.7598	8.7906	7.4214	8.0190	10.4234	13.9903	17.7639	20.7331	22.1023	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	278.8333	281.7267	274.4354	258.9131	239.3189	220.9031	208.6002	205.7068	212.9981	228.5205	248.1147	266.5304	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	(71)

Water heating gains (Table 5)

	125.1477	122.6013	117.5637	106.3422	99.5078	92.3465	87.8691	91.4488	95.6604	103.6061	114.3535	123.6993	(72)

Total internal gains

	518.1243	516.0669	500.1711	469.6536	440.2559	413.3096	397.1270	400.2177	415.2875	442.5292	475.8399	504.9707	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5900	9.5462	0.6300	0.8270	0.7700	12.3738	(74)
Northeast	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(75)
Northwest	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(81)

Solar gains	69.4528	148.6778	276.6041	477.3240	638.3689	663.6861	627.6104	484.0300	333.4428	179.5688	89.3871	58.2939	(83)
Total gains	587.5771	664.7447	776.7752	946.9776	1078.6248	1076.9957	1024.7374	884.2477	748.7303	622.0980	565.2270	563.2647	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.2822	76.2822	76.8316	78.5282	78.8183	80.0003	80.6047	80.6047	79.4049	77.9544	77.3889	77.6706	
alpha	6.0855	6.0855	6.1221	6.2352	6.2546	6.3334	6.3736	6.3736	6.2937	6.1970	6.1593	6.1780	
util living area	0.9523	0.9151	0.8170	0.6098	0.4269	0.3197	0.2609	0.3073	0.4846	0.7655	0.9164	0.9604	(86)
MIT	20.4877	20.6359	20.8375	20.9735	20.9971	20.9996	20.9999	20.9998	20.9955	20.9203	20.6918	20.4562	(87)
Th 2	20.3354	20.3354	20.3399	20.3533	20.3555	20.3645	20.3689	20.3689	20.3600	20.3488	20.3443	20.3466	(88)
util rest of house	0.9439	0.9018	0.7950	0.5824	0.4005	0.2937	0.2339	0.2760	0.4477	0.7329	0.9011	0.9533	(89)
MIT 2	19.7510	19.9303	20.1689	20.3280	20.3531	20.3642	20.3689	20.3688	20.3565	20.2729	20.0092	19.7217	(90)
Living area fraction									fLA = Living area / (4) =			0.4663	(91)
MIT	20.0946	20.2593	20.4807	20.6290	20.6534	20.6605	20.6631	20.6630	20.6545	20.5748	20.3275	20.0642	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0946	20.2593	20.4807	20.6290	20.6534	20.6605	20.6631	20.6630	20.6545	20.5748	20.3275	20.0642	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9404	0.9002	0.7998	0.5942	0.4127	0.3059	0.2465	0.2906	0.4648	0.7445	0.9007	0.9498	(94)
Useful gains	552.5820	598.3955	621.2894	562.6696	445.1856	329.4043	252.6245	256.9595	347.9863	463.1695	509.0750	534.9752	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	750.1804	739.2834	684.3902	572.7824	446.2351	329.5308	252.6499	257.0288	349.5347	492.9470	626.8071	744.4884	(97)
Space heating kWh	147.0132	94.6766	46.9470	7.2812	0.7808	0.0000	0.0000	0.0000	0.0000	22.1544	84.7671	155.8778	(98a)
Space heating requirement - total per year (kWh/year)												559.4982	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	147.0132	94.6766	46.9470	7.2812	0.7808	0.0000	0.0000	0.0000	0.0000	22.1544	84.7671	155.8778	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												559.4982	
Space heating per m2											(98c) / (4) =	8.5289	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	147.0132	94.6766	46.9470	7.2812	0.7808	0.0000	0.0000	0.0000	0.0000	22.1544	84.7671	155.8778	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	147.0132	94.6766	46.9470	7.2812	0.7808	0.0000	0.0000	0.0000	0.0000	22.1544	84.7671	155.8778	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
Efficiency of water heater												100.0000	(216)

(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	12.1045	10.9331	12.1045	11.7141	12.1045	11.7141	12.1045	12.1045	11.7141	12.1045	11.7141	12.1045	(231)
Lighting	18.8229	15.1004	13.5963	9.9612	7.6943	6.2863	7.0190	9.1236	11.8506	15.5487	17.5622	19.3460	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.3335	-24.2496	-40.7429	-53.0154	-61.7317	-58.2186	-57.7804	-50.9772	-41.3377	-29.2830	-16.9564	-12.3241	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4576	-6.4518	-15.8354	-29.2573	-40.7194	-40.3248	-40.3981	-31.3264	-21.1298	-10.2536	-3.6695	-1.9361	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	559.4982	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2461.0688	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	142.5210	(230a)
Total electricity for the above, kWh/year	142.5210	(231)
Electricity for lighting (calculated in Appendix L)	151.9116	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-704.7104	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2610.2892	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	559.4982	25.1600	140.7697	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	25.1600	619.2049	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	142.5210	25.1600	35.8583	(249)
Energy for lighting	151.9116	25.1600	38.2210	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.9505	25.1600	-115.9752	
PV Unit electricity exported	-243.7598	5.8100	-14.1624	
Total			-130.1376	(252)
Total energy cost			703.9163	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	559.4982	0.1585	88.6595	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2461.0688	0.1413	347.7259	(264)
Space and water heating			436.3854	(265)
Pumps, fans and electric keep-hot	142.5210	0.1387	19.7694	(267)
Energy for lighting	151.9116	0.1443	21.9255	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.9505	0.1321	-60.8840	
PV Unit electricity exported	-243.7598	0.1225	-29.8531	
Total			-90.7371	(269)
Total CO2, kg/year			387.3433	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	559.4982	1.5865	887.6647	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	1.5225	3746.8812	(278)
Space and water heating			4634.5458	(279)
Pumps, fans and electric keep-hot	142.5210	1.5128	215.6057	(281)
Energy for lighting	151.9116	1.5338	233.0071	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.9505	1.4880	-685.9054	
PV Unit electricity exported	-243.7598	0.4495	-109.5580	
Total			-795.4634	(283)
Total Primary energy kWh/year			4287.6952	(286)

SAP 10 EPC IMPROVEMENTS

Unit 405 L03_Copy

Current energy efficiency rating: C 77
Current environmental impact rating: A 95

N Solar water heating	Not applicable
U Solar photovoltaic panels	Not applicable
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 77
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£834	£834	£0
Space heating	£177	£177	£0
Water heating	£619	£619	£0
Lighting	£38	£38	£0
Generated (PV)	-£130	-£130	£0
Total cost of fuels	£704	£704	£0
Total cost of uses	£704	£704	£0
Delivered energy	40 kWh/m²	40 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	65 kWh/m²	65 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.6000 (1b)	x	2.4000 (2b)	=	157.4400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	157.4400	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.3500	1.2357	23.9116			(27)
External Wall 1	41.2300	19.3500	21.8800	0.1400	3.0632	14.0000	306.3200	(29a)
Total net area of external elements Aum(A, m2)			41.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.9748			(33)
Party Wall 1			30.2400	0.0000	0.0000	20.0000	604.8000	(32)
Wall to corridor			14.1800	0.0000	0.0000	20.0000	283.6000	(32)
Party Floor 1			65.6000			80.0000	5248.0000	(32d)
Party Ceiling 1			65.6000			80.0000	5248.0000	(32b)
Internal Wall 1			114.4800			9.0000	1030.3200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12721.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		193.9183 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	15.2700	0.0700	1.0689
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.4500	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.4629 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	30.4377 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.7197	15.5541	15.3885	14.5604	14.3948	13.5668	13.5668	13.4012	13.8980	14.3948	14.7261	15.0573	(38)
Heat transfer coeff	46.1574	45.9918	45.8262	44.9981	44.8325	44.0045	44.0045	43.8389	44.3357	44.8325	45.1637	45.4950	(39)
Average = Sum(39)m / 12 =												44.9567	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7036	0.7011	0.6986	0.6859	0.6834	0.6708	0.6708	0.6683	0.6758	0.6834	0.6885	0.6935	(40)
HLP (average)												0.6853	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.1348 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
82.5173	81.2772	79.4702	76.0128	73.4613	70.6159	68.9985	70.7919	72.7577	75.8128	79.3445	82.2011	(42a)

Hot water usage for baths

25.9306	25.5455	25.0032	24.0033	23.2545	22.4243	21.9759	22.5144	23.1007	23.9891	25.0096	25.8429	(42b)

Hot water usage for other uses

36.4921	35.1651	33.8381	32.5112	31.1842	29.8572	29.8572	31.1842	32.5112	33.8381	35.1651	36.4921	(42c)

Average daily hot water use (litres/day)		133.2946 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.9400	141.9879	138.3115	132.5272	127.9000	122.8974	120.8316	124.4905	128.3696	133.6401	139.5193	144.5362	(44)
Energy conte	229.5496	202.1888	212.5797	181.4231	172.1780	151.1167	146.1353	154.1452	158.2926	181.3483	198.7708	226.3088	(45)
Energy content (annual)										Total = Sum(45)m =		2214.0368	
Distribution loss (46)m = 0.15 x (45)m	34.4324	30.3283	31.8870	27.2135	25.8267	22.6675	21.9203	23.1218	23.7439	27.2023	29.8156	33.9463	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
									Total per year (kWh/year) = Sum(64)m =		2461.0688	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000 (64a)

Heat gains from water heating, kWh/month

93.1099	82.3881	87.4674	76.5664	74.0338	66.4895	65.3746	68.0379	68.8755	77.0830	82.3345	92.0323	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.5047	19.1002	15.5334	11.7598	8.7906	7.4214	8.0190	10.4234	13.9903	17.7639	20.7331	22.1023	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	278.8333	281.7267	274.4354	258.9131	239.3189	220.9031	208.6002	205.7068	212.9981	228.5205	248.1147	266.5304	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(70)
Losses e.g. evaporation (negative values) (Table 5)	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	(71)
Water heating gains (Table 5)	125.1477	122.6013	117.5637	106.3422	99.5078	92.3465	87.8691	91.4488	95.6604	103.6061	114.3535	123.6993	(72)

Total internal gains

	518.1243	516.0669	500.1711	469.6536	440.2559	413.3096	397.1270	400.2177	415.2875	442.5292	475.8399	504.9707 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5900	10.6334	0.6300	0.8270	0.7700	13.7831	(74)
Northeast	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(75)
Northwest	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(81)

Solar gains	77.9864	157.0279	280.2162	458.5828	616.6334	657.8250	615.1898	490.0648	340.7231	191.0654	97.7876	63.9219	(83)
Total gains	596.1107	673.0949	780.3873	928.2365	1056.8893	1071.1345	1012.3168	890.2825	756.0106	633.5945	573.6275	568.8927	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.5559	76.8316	77.1093	78.5282	78.8183	80.3014	80.3014	80.6047	79.7015	78.8183	78.2402	77.6706	
alpha	6.1037	6.1221	6.1406	6.2352	6.2546	6.3534	6.3534	6.3736	6.3134	6.2546	6.2160	6.1780	
util living area	0.9437	0.8971	0.7825	0.5777	0.3938	0.2629	0.1913	0.2265	0.4038	0.7039	0.8971	0.9531	(86)
MIT	20.5409	20.6986	20.8811	20.9817	20.9983	20.9999	21.0000	21.0000	20.9987	20.9551	20.7496	20.5092	(87)
Th 2	20.3376	20.3399	20.3421	20.3533	20.3555	20.3667	20.3667	20.3689	20.3622	20.3555	20.3510	20.3466	(88)
util rest of house	0.9339	0.8815	0.7577	0.5488	0.3667	0.2369	0.1637	0.1954	0.3668	0.6677	0.8790	0.9447	(89)
MIT 2	19.8185	20.0094	20.2201	20.3364	20.3542	20.3666	20.3667	20.3689	20.3613	20.3148	20.0834	19.7875	(90)
Living area fraction									fLA = Living area / (4) =			0.4663	(91)
MIT	20.1554	20.3308	20.5284	20.6373	20.6546	20.6619	20.6620	20.6632	20.6585	20.6134	20.3941	20.1241	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1554	20.3308	20.5284	20.6373	20.6546	20.6619	20.6620	20.6632	20.6585	20.6134	20.3941	20.1241	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9309	0.8813	0.7649	0.5616	0.3793	0.2490	0.1766	0.2099	0.3841	0.6825	0.8803	0.9414	(94)
Useful gains	554.9067	593.1911	596.9001	521.2762	400.8703	266.7233	178.7442	186.8865	290.3468	432.4035	504.9500	535.5811	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	731.8424	709.6904	642.8668	528.1577	401.4553	266.7525	178.7466	186.8936	290.7766	448.9253	600.4104	724.4643	(97)
Space heating kWh	131.6402	78.2875	34.1992	4.9547	0.4352	0.0000	0.0000	0.0000	0.0000	12.2922	68.7315	140.5291	(98a)
Space heating requirement - total per year (kWh/year)												471.0696	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	131.6402	78.2875	34.1992	4.9547	0.4352	0.0000	0.0000	0.0000	0.0000	12.2922	68.7315	140.5291	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												471.0696	
Space heating per m2											(98c) / (4) =	7.1809	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	131.6402	78.2875	34.1992	4.9547	0.4352	0.0000	0.0000	0.0000	0.0000	12.2922	68.7315	140.5291	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	131.6402	78.2875	34.1992	4.9547	0.4352	0.0000	0.0000	0.0000	0.0000	12.2922	68.7315	140.5291	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	12.1045	10.9331	12.1045	11.7141	12.1045	11.7141	12.1045	12.1045	11.7141	12.1045	11.7141	12.1045	(231)
Lighting	18.8229	15.1004	13.5963	9.9612	7.6943	6.2863	7.0190	9.1236	11.8506	15.5487	17.5622	19.3460	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.8151	-25.1332	-40.5864	-50.8024	-59.6183	-57.3843	-56.4723	-50.9617	-41.6122	-30.4646	-18.2004	-13.3279	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													

(233b)m	-2.9195	-6.9836	-16.0113	-27.2032	-38.1758	-39.2360	-38.6794	-31.3088	-21.3818	-11.1448	-4.1988	-2.2253	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	471.0696	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2461.0688	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	142.5210	(230a)
Total electricity for the above, kWh/year	142.5210	(231)
Electricity for lighting (calculated in Appendix L)	151.9116	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-699.8470	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2526.7240	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	471.0696	16.4900	77.6794	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	16.4900	405.8302	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	142.5210	16.4900	23.5017	(249)
Energy for lighting	151.9116	16.4900	25.0502	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.3787	16.4900	-75.9165	
PV Unit electricity exported	-239.4682	5.5900	-13.3863	
Total			-89.3027	(252)
Total energy cost			442.7588	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.4412	(257)
SAP value		76.6387	
SAP rating (Section 12)		77	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	471.0696	0.1591	74.9382	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2461.0688	0.1413	347.7259	(264)
Space and water heating			422.6642	(265)
Pumps, fans and electric keep-hot	142.5210	0.1387	19.7694	(267)
Energy for lighting	151.9116	0.1443	21.9255	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.3787	0.1324	-60.9461	
PV Unit electricity exported	-239.4682	0.1230	-29.4551	
Total			-90.4011	(269)
Total CO2, kg/year			373.9580	(272)
CO2 emissions per m2			5.7000	(273)
EI value			95.4692	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		65.6000 (1b)	x	2.4000 (2b)	=	157.4400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.6000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	157.4400	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.3500	1.2357	23.9116			(27)
External Wall 1	41.2300	19.3500	21.8800	0.1400	3.0632	14.0000	306.3200	(29a)
Total net area of external elements Aum(A, m2)			41.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.9748			(33)
Party Wall 1			30.2400	0.0000	0.0000	20.0000	604.8000	(32)
Wall to corridor			14.1800	0.0000	0.0000	20.0000	283.6000	(32)
Party Floor 1			65.6000			80.0000	5248.0000	(32d)
Party Ceiling 1			65.6000			80.0000	5248.0000	(32b)
Internal Wall 1			114.4800			9.0000	1030.3200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12721.0400	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	193.9183	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	15.2700	0.0700	1.0689
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.4500	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	3.4629	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	30.4377	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.8853	15.8853	15.5541	14.5604	14.3948	13.7324	13.4012	13.4012	14.0636	14.8917	15.2229	15.0573	(38)
Heat transfer coeff	46.3230	46.3230	45.9918	44.9981	44.8325	44.1701	43.8389	43.8389	44.5013	45.3294	45.6606	45.4950	(39)
Average = Sum(39)m / 12 =												45.1085	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7061	0.7061	0.7011	0.6859	0.6834	0.6733	0.6683	0.6683	0.6784	0.6910	0.6960	0.6935	(40)
HLP (average)												0.6876	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1348	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
82.5173	81.2772	79.4702	76.0128	73.4613	70.6159	68.9985	70.7919	72.7577	75.8128	79.3445	82.2011	(42a)

Hot water usage for baths

25.9306	25.5455	25.0032	24.0033	23.2545	22.4243	21.9759	22.5144	23.1007	23.9891	25.0096	25.8429	(42b)

Hot water usage for other uses

36.4921	35.1651	33.8381	32.5112	31.1842	29.8572	29.8572	31.1842	32.5112	33.8381	35.1651	36.4921	(42c)

Average daily hot water use (litres/day)	133.2946 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.9400	141.9879	138.3115	132.5272	127.9000	122.8974	120.8316	124.4905	128.3696	133.6401	139.5193	144.5362	(44)
Energy conte	229.5496	202.1888	212.5797	181.4231	172.1780	151.1167	146.1353	154.1452	158.2926	181.3483	198.7708	226.3088	(45)
Energy content (annual)										Total = Sum(45)m =		2214.0368	

Distribution loss (46)m = 0.15 x (45)m

34.4324	30.3283	31.8870	27.2135	25.8267	22.6675	21.9203	23.1218	23.7439	27.2023	29.8156	33.9463	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)

Total per year (kWh/year) = Sum(64)m = 2461.0688 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

93.1099	82.3881	87.4674	76.5664	74.0338	66.4895	65.3746	68.0379	68.8755	77.0830	82.3345	92.0323	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

21.5047	19.1002	15.5334	11.7598	8.7906	7.4214	8.0190	10.4234	13.9903	17.7639	20.7331	22.1023	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

278.8333	281.7267	274.4354	258.9131	239.3189	220.9031	208.6002	205.7068	212.9981	228.5205	248.1147	266.5304	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	(71)

Water heating gains (Table 5)

125.1477	122.6013	117.5637	106.3422	99.5078	92.3465	87.8691	91.4488	95.6604	103.6061	114.3535	123.6993	(72)

Total internal gains

518.1243	516.0669	500.1711	469.6536	440.2559	413.3096	397.1270	400.2177	415.2875	442.5292	475.8399	504.9707	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5900	9.5462	0.6300	0.8270	0.7700	12.3738	(74)
Northeast	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(75)
Northwest	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(81)

Solar gains 69.4528	148.6778	276.6041	477.3240	638.3689	663.6861	627.6104	484.0300	333.4428	179.5688	89.3871	58.2939	(83)
Total gains 587.5771	664.7447	776.7752	946.9776	1078.6248	1076.9957	1024.7374	884.2477	748.7303	622.0980	565.2270	563.2647	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.2822	76.2822	76.8316	78.5282	78.8183	80.0003	80.6047	80.6047	79.4049	77.9544	77.3889	77.6706	
alpha	6.0855	6.0855	6.1221	6.2352	6.2546	6.3334	6.3736	6.3736	6.2937	6.1970	6.1593	6.1780	
util living area	0.9523	0.9151	0.8170	0.6098	0.4269	0.3197	0.2609	0.3073	0.4846	0.7655	0.9164	0.9604	(86)
MIT	20.4877	20.6359	20.8375	20.9735	20.9971	20.9996	20.9999	20.9998	20.9955	20.9203	20.6918	20.4562	(87)
Th 2	20.3354	20.3354	20.3399	20.3533	20.3555	20.3645	20.3689	20.3689	20.3600	20.3488	20.3443	20.3466	(88)
util rest of house	0.9439	0.9018	0.7950	0.5824	0.4005	0.2937	0.2339	0.2760	0.4477	0.7329	0.9011	0.9533	(89)
MIT 2	19.7510	19.9303	20.1689	20.3280	20.3531	20.3642	20.3689	20.3688	20.3565	20.2729	20.0092	19.7217	(90)
Living area fraction									fLA = Living area / (4) =			0.4663	(91)
MIT	20.0946	20.2593	20.4807	20.6290	20.6534	20.6605	20.6631	20.6630	20.6545	20.5748	20.3275	20.0642	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0946	20.2593	20.4807	20.6290	20.6534	20.6605	20.6631	20.6630	20.6545	20.5748	20.3275	20.0642	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9404	0.9002	0.7998	0.5942	0.4127	0.3059	0.2465	0.2906	0.4648	0.7445	0.9007	0.9498	(94)
Useful gains	552.5820	598.3955	621.2894	562.6696	445.1856	329.4043	252.6245	256.9595	347.9863	463.1695	509.0750	534.9752	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	750.1804	739.2834	684.3902	572.7824	446.2351	329.5308	252.6499	257.0288	349.5347	492.9470	626.8071	744.4884	(97)
Space heating kWh	147.0132	94.6766	46.9470	7.2812	0.7808	0.0000	0.0000	0.0000	0.0000	22.1544	84.7671	155.8778	(98a)

Space heating requirement - total per year (kWh/year) 559.4982

Solar heating kWh

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)

Solar heating contribution - total per year (kWh/year) 0.0000

Space heating kWh

147.0132	94.6766	46.9470	7.2812	0.7808	0.0000	0.0000	0.0000	0.0000	22.1544	84.7671	155.8778	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 559.4982

Space heating per m2 (98c) / (4) = 8.5289 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	147.0132	94.6766	46.9470	7.2812	0.7808	0.0000	0.0000	0.0000	0.0000	22.1544	84.7671	155.8778	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	147.0132	94.6766	46.9470	7.2812	0.7808	0.0000	0.0000	0.0000	0.0000	22.1544	84.7671	155.8778	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	12.1045	10.9331	12.1045	11.7141	12.1045	11.7141	12.1045	12.1045	11.7141	12.1045	11.7141	12.1045	(231)
Lighting	18.8229	15.1004	13.5963	9.9612	7.6943	6.2863	7.0190	9.1236	11.8506	15.5487	17.5622	19.3460	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.3335	-24.2496	-40.7429	-53.0154	-61.7317	-58.2186	-57.7804	-50.9772	-41.3377	-29.2830	-16.9564	-12.3241	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4576	-6.4518	-15.8354	-29.2573	-40.7194	-40.3248	-40.3981	-31.3264	-21.1298	-10.2536	-3.6695	-1.9361	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												559.4982	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2461.0688	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)													
mechanical ventilation fans (SFP = 0.7420)												142.5210	(230a)
Total electricity for the above, kWh/year												142.5210	(231)
Electricity for lighting (calculated in Appendix L)												151.9116	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-704.7104	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2610.2892	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	559.4982	25.1600	140.7697	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	25.1600	619.2049	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	142.5210	25.1600	35.8583	(249)
Energy for lighting	151.9116	25.1600	38.2210	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.9505	25.1600	-115.9752	
PV Unit electricity exported	-243.7598	5.8100	-14.1624	
Total			-130.1376	(252)
Total energy cost			703.9163	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	559.4982	0.1585	88.6595	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2461.0688	0.1413	347.7259	(264)
Space and water heating			436.3854	(265)
Pumps, fans and electric keep-hot	142.5210	0.1387	19.7694	(267)
Energy for lighting	151.9116	0.1443	21.9255	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.9505	0.1321	-60.8840	
PV Unit electricity exported	-243.7598	0.1225	-29.8531	
Total			-90.7371	(269)
Total CO2, kg/year			387.3433	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	559.4982	1.5865	887.6647	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	1.5225	3746.8812	(278)
Space and water heating			4634.5458	(279)
Pumps, fans and electric keep-hot	142.5210	1.5128	215.6057	(281)
Energy for lighting	151.9116	1.5338	233.0071	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.9505	1.4880	-685.9054	
PV Unit electricity exported	-243.7598	0.4495	-109.5580	
Total			-795.4634	(283)
Total Primary energy kWh/year			4287.6952	(286)

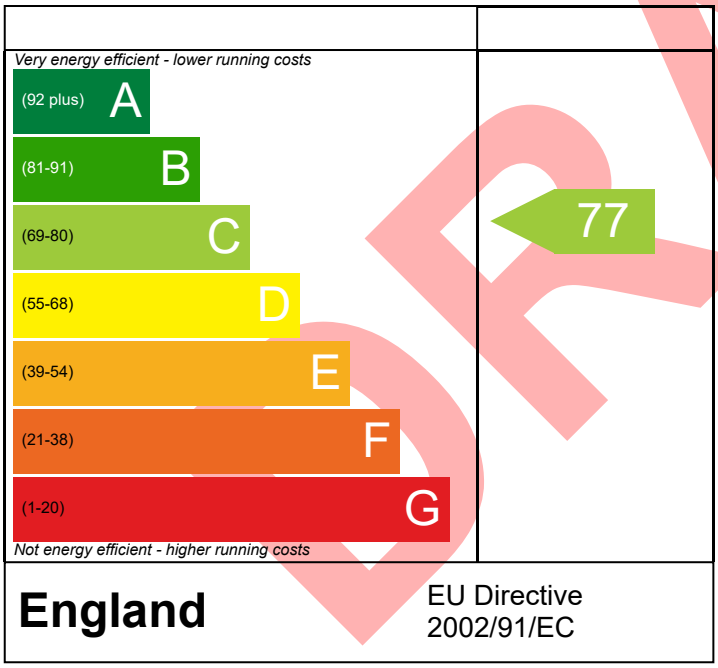
Predicted Energy Assessment

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	65.6 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

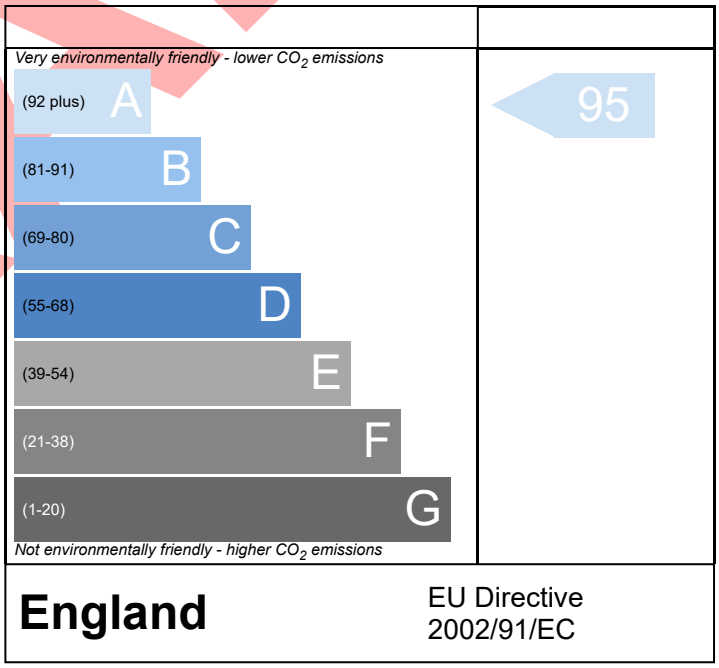
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:23

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	71 m^2
Site Reference	Unit 406 L03_Copy	Plot Reference	Unit 406 L03_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*10.3 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	4.64 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*55.61 kWh$_{PE}$/m^2*	
Dwelling primary energy	52.51 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*18.0 kWh/m^2*	
Dwelling fabric energy efficiency	17.1 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	11	0.14 **(!)**
Party wall: Party Wall (1)	52.62	0 **(!)**
Party wall: Party Wall (2)	15.55	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	11.81	North East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.92 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 406 L03_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 406 L03_Copy	**Prop Type Ref**	Unit 406 L03
Property			

SAP Rating	80 C	**DER**	4.64	**TER**	10.30
Environmental	96 A	**% DER < TER**			54.95
CO_2 Emissions (t/year)	0.33	**DFEE**	17.06	**TFEE**	17.98
Compliance Check	See BREL	**% DFEE < TFEE**			5.14
% DPER < TPER	5.58	**DPER**	52.51	**TPER**	55.61

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14111.0700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		198.8035 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545

E4 Jamb	13.9200	0.0500	0.6960	
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.8660 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.2026	16.0392	15.8758	15.0589	14.8955	14.0786	14.0786	13.9153	14.4054	14.8955	15.2223	15.5490	(38)
Heat transfer coeff	34.2027	34.0393	33.8759	33.0590	32.8956	32.0787	32.0787	31.9154	32.4055	32.8956	33.2224	33.5491	(39)

Average = Sum(39)m / 12 = 33.0182

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4819	0.4796	0.4773	0.4658	0.4634	0.4519	0.4519	0.4496	0.4565	0.4634	0.4681	0.4727	(40)
HLP (average)												0.4652	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2697 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day) 138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)

Energy content (annual) Total = Sum(45)m = 2297.5146

Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)

Total per year (kWh/year) = Sum(64)m = 2544.5466 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(75)

Solar gains	48.1118	97.9329	176.4440	289.7718	389.5101	415.2590	388.4663	309.6898	214.9998	119.6818	60.5371	39.2905	(83)
Total gains	594.4583	642.1364	703.7861	784.8198	853.3337	850.5024	806.5649	731.0038	652.3178	585.8947	562.0348	571.6354	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.6034	115.1535	115.7089	118.5680	119.1569	122.1913	122.1913	122.8168	120.9592	119.1569	117.9849	116.8358	
alpha	8.6402	8.6769	8.7139	8.9045	8.9438	9.1461	9.1461	9.1878	9.0639	8.9438	8.8657	8.7891	
util living area													
	0.8775	0.8131	0.6885	0.5091	0.3585	0.2414	0.1750	0.2008	0.3428	0.5819	0.7916	0.8914	(86)
MIT	20.8955	20.9454	20.9859	20.9990	21.0000	21.0000	21.0000	21.0000	21.0000	20.9975	20.9643	20.8857	(87)
Th 2	20.5375	20.5396	20.5417	20.5523	20.5544	20.5651	20.5651	20.5672	20.5608	20.5544	20.5502	20.5460	(88)
util rest of house													
	0.8633	0.7958	0.6685	0.4904	0.3413	0.2250	0.1577	0.1819	0.3210	0.5575	0.7712	0.8782	(89)
MIT 2	20.4234	20.4818	20.5277	20.5514	20.5544	20.5651	20.5651	20.5672	20.5608	20.5523	20.5139	20.4203	(90)
Living area fraction										fLA = Living area / (4) =		0.4060	(91)
MIT	20.6151	20.6700	20.7137	20.7331	20.7353	20.7417	20.7417	20.7429	20.7391	20.7331	20.6968	20.6093	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6151	20.6700	20.7137	20.7331	20.7353	20.7417	20.7417	20.7429	20.7391	20.7331	20.6968	20.6093	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8657	0.8008	0.6760	0.4979	0.3483	0.2316	0.1647	0.1896	0.3298	0.5673	0.7780	0.8801	(94)
Useful gains	514.6438	514.2072	475.7927	390.7925	297.2070	197.0168	132.8596	138.6063	215.1380	332.4041	437.2668	503.1190	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	558.0190	536.7995	481.5030	391.1911	297.2225	197.0170	132.8596	138.6063	215.1442	333.3337	451.7174	550.5165	(97)
Space heating kWh													
	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(98a)
Space heating requirement - total per year (kWh/year)												98.3601	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												98.3601	
Space heating per m2											(98c) / (4) =	1.3857	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)
Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.8048	-26.6478	-43.2456	-54.4944	-64.0203	-61.6099	-60.6290	-54.7463	-44.7493	-32.6681	-19.3717	-14.1696	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.4726	-8.1139	-18.0130	-29.9352	-41.8274	-42.9674	-42.3587	-34.2994	-23.4325	-12.3679	-4.8722	-2.6645	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	98.3601	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2544.5466	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	154.2094	(230a)
Total electricity for the above, kWh/year	154.2094	(231)
Electricity for lighting (calculated in Appendix L)	163.7369	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-757.4814	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2203.3717	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	98.3601	16.4900	16.2196	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	16.4900	419.5957	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	16.4900	25.4291	(249)
Energy for lighting	163.7369	16.4900	27.0002	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.1568	16.4900	-81.3216	
PV Unit electricity exported	-264.3246	5.5900	-14.7757	
Total			-96.0973	(252)
Total energy cost			392.1474	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2172	(257)
SAP value		80.2689	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	98.3601	0.1606	15.7950	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			375.3396	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.1568	0.1323	-65.2544	
PV Unit electricity exported	-264.3246	0.1234	-32.6244	
Total			-97.8788	(269)
Total CO2, kg/year			322.4838	(272)
CO2 emissions per m2			4.5400	(273)
EI value			96.2741	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14111.0700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 198.8035 (35)
List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4	Jamb	13.9200	0.0500	0.6960
E7	Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18	Party wall between dwellings	5.4000	0.0600	0.3240
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.8660 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3659	16.3659	16.0392	15.0589	14.8955	14.2420	13.9153	13.9153	14.5688	15.3857	15.7124	15.5490	(38)
Heat transfer coeff	34.3660	34.3660	34.0393	33.0590	32.8956	32.2421	31.9154	31.9154	32.5689	33.3858	33.7125	33.5491	(39)

Average = Sum(39)m / 12 = 33.1679

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4842	0.4842	0.4796	0.4658	0.4634	0.4542	0.4496	0.4496	0.4588	0.4704	0.4750	0.4727	(40)
HLP (average)												0.4673	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2697 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day) 138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
										Total per year (kWh/year) = Sum(64)m =		2544.5466	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)													
	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains													
	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(75)

Solar gains	42.7730	92.6022	174.0550	301.5827	403.2921	419.0362	396.3745	305.8819	210.3213	112.3593	55.2465	35.7661	(83)
Total gains	589.1195	636.8057	701.3971	796.6307	867.1157	854.2796	814.4731	727.1958	647.6393	578.5722	556.7443	568.1110	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.0586	114.0586	115.1535	118.5680	119.1569	121.5721	122.8168	122.8168	120.3524	117.4076	116.2696	116.8358	
alpha	8.6039	8.6039	8.6769	8.9045	8.9438	9.1048	9.1878	9.1878	9.0235	8.8272	8.7513	8.7891	
util living area													
	0.8948	0.8436	0.7313	0.5425	0.3907	0.2944	0.2390	0.2721	0.4123	0.6468	0.8263	0.9072	(86)
MIT	20.8725	20.9227	20.9763	20.9982	20.9999	21.0000	21.0000	21.0000	20.9999	20.9935	20.9463	20.8626	(87)
Th 2	20.5354	20.5354	20.5396	20.5523	20.5544	20.5630	20.5672	20.5672	20.5587	20.5481	20.5438	20.5460	(88)
util rest of house													
	0.8819	0.8278	0.7122	0.5242	0.3738	0.2779	0.2221	0.2531	0.3901	0.6222	0.8073	0.8955	(89)
MIT 2	20.3944	20.4521	20.5153	20.5506	20.5544	20.5629	20.5672	20.5672	20.5586	20.5421	20.4880	20.3930	(90)
Living area fraction										fLA = Living area / (4) =		0.4060	(91)
MIT	20.5885	20.6432	20.7024	20.7323	20.7353	20.7404	20.7429	20.7429	20.7378	20.7254	20.6741	20.5837	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5885	20.6432	20.7024	20.7323	20.7353	20.7404	20.7429	20.7429	20.7378	20.7254	20.6741	20.5837	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8835	0.8316	0.7190	0.5316	0.3807	0.2846	0.2290	0.2608	0.3991	0.6319	0.8129	0.8965	(94)
Useful gains	520.4584	529.5388	504.3299	423.4968	330.0802	243.1167	186.4792	189.6703	258.4856	365.5902	452.5648	509.3180	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	573.5183	561.6502	514.0764	424.2235	330.1165	243.1185	186.4794	189.6709	258.5247	368.0921	474.4733	566.4323	(97)
Space heating kWh													
	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930	(98a)
Space heating requirement - total per year (kWh/year)												128.9856	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												128.9856	
Space heating per m2										(98c) / (4) =		1.8172	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)

Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-15.2338	-25.6721	-43.2787	-56.7922	-66.2633	-62.5005	-62.0252	-54.7629	-44.4553	-31.3120	-18.0261	-13.1034 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.9401	-7.5576	-17.9590	-32.2559	-44.6250	-44.1582	-44.2385	-34.3187	-23.1566	-11.4806	-4.2984	-2.3312 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	128.9856 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2544.5466 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	154.2094 (230a)
Total electricity for the above, kWh/year	154.2094 (231)
Electricity for lighting (calculated in Appendix L)	163.7369 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-762.7453 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2228.7332 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	128.9856	25.1600	32.4528	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	25.1600	640.2079	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	25.1600	38.7991	(249)
Energy for lighting	163.7369	25.1600	41.1962	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.4255	25.1600	-124.1459	
PV Unit electricity exported	-269.3198	5.8100	-15.6475	
Total			-139.7933	(252)
Total energy cost			612.8627	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	128.9856	0.1600	20.6366	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			380.1811	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.4255	0.1320	-65.1384	
PV Unit electricity exported	-269.3198	0.1229	-33.1064	
Total			-98.2448	(269)
Total CO2, kg/year			326.9594	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	128.9856	1.5921	205.3619	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	1.5225	3874.0629	(278)
Space and water heating			4079.4248	(279)
Pumps, fans and electric keep-hot	154.2094	1.5128	233.2880	(281)
Energy for lighting	163.7369	1.5338	251.1452	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.4255	1.4878	-734.0970	
PV Unit electricity exported	-269.3198	0.4511	-121.5003	
Total			-855.5973	(283)
Total Primary energy kWh/year			3708.2608	(286)

SAP 10 EPC IMPROVEMENTS

Unit 406 L03_Copy

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 80
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£753	£753	£0
Space heating	£71	£71	£0
Water heating	£640	£640	£0
Lighting	£41	£41	£0
Generated (PV)	-£140	-£140	£0
Total cost of fuels	£613	£613	£0
Total cost of uses	£612	£612	£0
Delivered energy	31 kWh/m²	31 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	52 kWh/m²	52 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14111.0700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		198.8035 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.8660 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.2026	16.0392	15.8758	15.0589	14.8955	14.0786	14.0786	13.9153	14.4054	14.8955	15.2223	15.5490	(38)
Heat transfer coeff	34.2027	34.0393	33.8759	33.0590	32.8956	32.0787	32.0787	31.9154	32.4055	32.8956	33.2224	33.5491	(39)
Average = Sum(39)m / 12 =												33.0182	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4819	0.4796	0.4773	0.4658	0.4634	0.4519	0.4519	0.4496	0.4565	0.4634	0.4681	0.4727	(40)
HLP (average)												0.4652	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.2697 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)

Hot water usage for baths

26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)

Hot water usage for other uses

37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day)		138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
									Total per year (kWh/year) = Sum(64)m =		2544.5466	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast				11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(75)
Solar gains	48.1118	97.9329	176.4440	289.7718	389.5101	415.2590	388.4663	309.6898	214.9998	119.6818	60.5371	39.2905	(83)
Total gains	594.4583	642.1364	703.7861	784.8198	853.3337	850.5024	806.5649	731.0038	652.3178	585.8947	562.0348	571.6354	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.6034	115.1535	115.7089	118.5680	119.1569	122.1913	122.1913	122.8168	120.9592	119.1569	117.9849	116.8358	
alpha	8.6402	8.6769	8.7139	8.9045	8.9438	9.1461	9.1461	9.1878	9.0639	8.9438	8.8657	8.7891	
util living area	0.8775	0.8131	0.6885	0.5091	0.3585	0.2414	0.1750	0.2008	0.3428	0.5819	0.7916	0.8914	(86)
MIT	20.8955	20.9454	20.9859	20.9990	21.0000	21.0000	21.0000	21.0000	21.0000	20.9975	20.9643	20.8857	(87)
Th 2	20.5375	20.5396	20.5417	20.5523	20.5544	20.5651	20.5651	20.5672	20.5608	20.5544	20.5502	20.5460	(88)
util rest of house	0.8633	0.7958	0.6685	0.4904	0.3413	0.2250	0.1577	0.1819	0.3210	0.5575	0.7712	0.8782	(89)
MIT 2	20.4234	20.4818	20.5277	20.5514	20.5544	20.5651	20.5651	20.5672	20.5608	20.5523	20.5139	20.4203	(90)
Living area fraction									fLA = Living area / (4) =			0.4060	(91)
MIT	20.6151	20.6700	20.7137	20.7331	20.7353	20.7417	20.7417	20.7429	20.7391	20.7331	20.6968	20.6093	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6151	20.6700	20.7137	20.7331	20.7353	20.7417	20.7417	20.7429	20.7391	20.7331	20.6968	20.6093	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8657	0.8008	0.6760	0.4979	0.3483	0.2316	0.1647	0.1896	0.3298	0.5673	0.7780	0.8801	(94)
Useful gains	514.6438	514.2072	475.7927	390.7925	297.2070	197.0168	132.8596	138.6063	215.1380	332.4041	437.2668	503.1190	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	558.0190	536.7995	481.5030	391.1911	297.2225	197.0170	132.8596	138.6063	215.1442	333.3337	451.7174	550.5165	(97)
Space heating kWh	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(98a)
Space heating requirement - total per year (kWh/year)												98.3601	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												98.3601	
Space heating per m2										(98c) / (4) =		1.3857	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)
Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.8048	-26.6478	-43.2456	-54.4944	-64.0203	-61.6099	-60.6290	-54.7463	-44.7493	-32.6681	-19.3717	-14.1696	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.4726	-8.1139	-18.0130	-29.9352	-41.8274	-42.9674	-42.3587	-34.2994	-23.4325	-12.3679	-4.8722	-2.6645	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												98.3601	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2544.5466	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	154.2094	(230a)
Total electricity for the above, kWh/year	154.2094	(231)
Electricity for lighting (calculated in Appendix L)	163.7369	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-757.4814	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2203.3717	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	98.3601	16.4900	16.2196	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	16.4900	419.5957	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	16.4900	25.4291	(249)
Energy for lighting	163.7369	16.4900	27.0002	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.1568	16.4900	-81.3216	
PV Unit electricity exported	-264.3246	5.5900	-14.7757	
Total			-96.0973	(252)
Total energy cost			392.1474	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2172	(257)
SAP value		80.2689	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	98.3601	0.1606	15.7950	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			375.3396	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.1568	0.1323	-65.2544	
PV Unit electricity exported	-264.3246	0.1234	-32.6244	
Total			-97.8788	(269)
Total CO2, kg/year			322.4838	(272)
CO2 emissions per m2			4.5400	(273)
EI value			96.2741	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 14111.0700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.8035 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	1.8660 (36)
Point Thermal bridges (36a) =	0.0000
Total fabric heat loss (33) + (36) + (36a) =	18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3659	16.3659	16.0392	15.0589	14.8955	14.2420	13.9153	13.9153	14.5688	15.3857	15.7124	15.5490	(38)
Heat transfer coeff	34.3660	34.3660	34.0393	33.0590	32.8956	32.2421	31.9154	31.9154	32.5689	33.3858	33.7125	33.5491	(39)
Average = Sum(39)m / 12 =												33.1679	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4842	0.4842	0.4796	0.4658	0.4634	0.4542	0.4496	0.4496	0.4588	0.4704	0.4750	0.4727	(40)
HLP (average)												0.4673	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2697 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)
Average daily hot water use (litres/day)												138.3203	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
									Total per year (kWh/year) = Sum(64)m =			2544.5466	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(75)

Solar gains	42.7730	92.6022	174.0550	301.5827	403.2921	419.0362	396.3745	305.8819	210.3213	112.3593	55.2465	35.7661	(83)
Total gains	589.1195	636.8057	701.3971	796.6307	867.1157	854.2796	814.4731	727.1958	647.6393	578.5722	556.7443	568.1110	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.0586	114.0586	115.1535	118.5680	119.1569	121.5721	122.8168	122.8168	120.3524	117.4076	116.2696	116.8358	
alpha	8.6039	8.6039	8.6769	8.9045	8.9438	9.1048	9.1878	9.1878	9.0235	8.8272	8.7513	8.7891	
util living area	0.8948	0.8436	0.7313	0.5425	0.3907	0.2944	0.2390	0.2721	0.4123	0.6468	0.8263	0.9072	(86)
MIT	20.8725	20.9227	20.9763	20.9982	20.9999	21.0000	21.0000	21.0000	20.9999	20.9935	20.9463	20.8626	(87)
Th 2	20.5354	20.5354	20.5396	20.5523	20.5544	20.5630	20.5672	20.5672	20.5587	20.5481	20.5438	20.5460	(88)
util rest of house	0.8819	0.8278	0.7122	0.5242	0.3738	0.2779	0.2221	0.2531	0.3901	0.6222	0.8073	0.8955	(89)
MIT 2	20.3944	20.4521	20.5153	20.5506	20.5544	20.5629	20.5672	20.5672	20.5586	20.5421	20.4880	20.3930	(90)
Living area fraction										fLA = Living area / (4) =		0.4060	(91)
MIT	20.5885	20.6432	20.7024	20.7323	20.7353	20.7404	20.7429	20.7429	20.7378	20.7254	20.6741	20.5837	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5885	20.6432	20.7024	20.7323	20.7353	20.7404	20.7429	20.7429	20.7378	20.7254	20.6741	20.5837	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8835	0.8316	0.7190	0.5316	0.3807	0.2846	0.2290	0.2608	0.3991	0.6319	0.8129	0.8965	(94)
Useful gains	520.4584	529.5388	504.3299	423.4968	330.0802	243.1167	186.4792	189.6703	258.4856	365.5902	452.5648	509.3180	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	573.5183	561.6502	514.0764	424.2235	330.1165	243.1185	186.4794	189.6709	258.5247	368.0921	474.4733	566.4323	(97)
Space heating kWh	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930	(98a)
Space heating requirement - total per year (kWh/year)												128.9856	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												128.9856	
Space heating per m2											(98c) / (4) =	1.8172	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													

	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972 (231)
Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-15.2338	-25.6721	-43.2787	-56.7922	-66.2633	-62.5005	-62.0252	-54.7629	-44.4553	-31.3120	-18.0261	-13.1034 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.9401	-7.5576	-17.9590	-32.2559	-44.6250	-44.1582	-44.2385	-34.3187	-23.1566	-11.4806	-4.2984	-2.3312 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	128.9856 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2544.5466 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	154.2094 (230a)
Total electricity for the above, kWh/year	154.2094 (231)
Electricity for lighting (calculated in Appendix L)	163.7369 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-762.7453 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2228.7332 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	128.9856	25.1600	32.4528	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	25.1600	640.2079	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	25.1600	38.7991	(249)
Energy for lighting	163.7369	25.1600	41.1962	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.4255	25.1600	-124.1459	
PV Unit electricity exported	-269.3198	5.8100	-15.6475	
Total			-139.7933	(252)
Total energy cost			612.8627	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	128.9856	0.1600	20.6366	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			380.1811	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.4255	0.1320	-65.1384	
PV Unit electricity exported	-269.3198	0.1229	-33.1064	
Total			-98.2448	(269)
Total CO2, kg/year			326.9594	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	128.9856	1.5921	205.3619	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	1.5225	3874.0629	(278)
Space and water heating			4079.4248	(279)

Pumps, fans and electric keep-hot	154.2094	1.5128	233.2880	(281)
Energy for lighting	163.7369	1.5338	251.1452	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.4255	1.4878	-734.0970	
PV Unit electricity exported	-269.3198	0.4511	-121.5003	
Total			-855.5973	(283)
Total Primary energy kWh/year			3708.2608	(286)

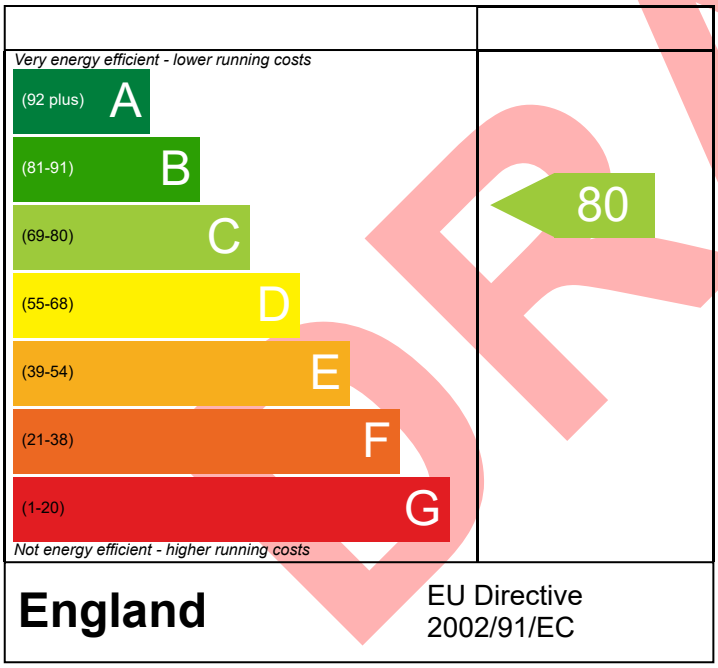
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	70.98 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

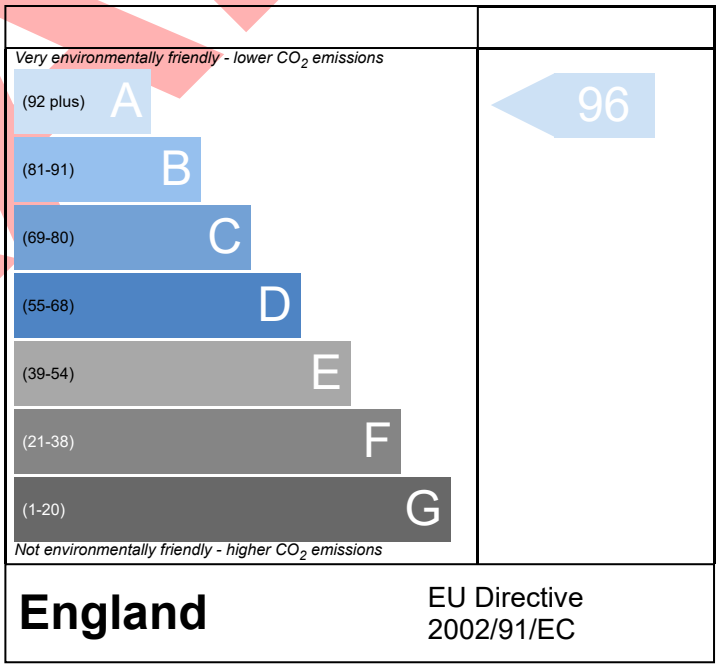
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:24

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	66 m^2
Site Reference	Unit 407 L03_Copy	Plot Reference	Unit 407 L03_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.14 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	5.32 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*60.16 kWh_{PE}/m^2*	
Dwelling primary energy	59.44 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*21.4 kWh/m^2*	
Dwelling fabric energy efficiency	21.6 kWh/m^2	FAIL

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	25.12	0.14 **(!)**
Party wall: Party Wall (1)	55.02	0 **(!)**
Party wall: Party Wall (2)	3.85	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SE, Opening Type 1	11.81	South East	0.83	1.3
NE, Opening Type 1	7.88	North East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.86 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 407 L03_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 407 L03_Copy	**Prop Type Ref**	Unit 407 L03
Property			

SAP Rating	78 C	**DER**	5.32	**TER**	11.14
Environmental	96 A	**% DER < TER**			52.24
CO_2 Emissions (t/year)	0.36	**DFEE**	21.59	**TFEE**	21.38
Compliance Check	See BREL	**% DFEE < TFEE**			-0.98
% DPER < TPER	1.20	**DPER**	59.44	**TPER**	60.16

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.4100	(1b)	x 2.4000	(2b) =	159.3840	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.4100					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		159.3840	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.8100	19.6900	25.1200	0.1400	3.5168	14.0000	351.6800	(29a)
Total net area of external elements Aum(A, m2)			44.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.8485			(33)
Party Wall 1			55.0200	0.0000	0.0000	20.0000	1100.4000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.4100			80.0000	5312.8000	(32d)
Party Ceiling 1			66.4100			80.0000	5312.8000	(32b)
Internal Wall 1			140.4500			9.0000	1264.0500	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13418.7300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.0589 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240

E4 Jamb	23.2000	0.0500	1.1600	
E7 Party floor between dwellings (in blocks of flats)	16.5900	0.0700	1.1613	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	21.8000	0.0000	0.0000	
E16 Corner (normal)	5.4000	0.0900	0.4860	
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				3.5553 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	31.4038 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.9138	15.7461	15.5785	14.7402	14.5726	13.7343	13.7343	13.5667	14.0696	14.5726	14.9079	15.2432	(38)
Heat transfer coeff	47.3176	47.1500	46.9823	46.1441	45.9764	45.1382	45.1382	44.9705	45.4735	45.9764	46.3117	46.6470	(39)
Average = Sum(39)m / 12 =												46.1022	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7125	0.7100	0.7075	0.6948	0.6923	0.6797	0.6797	0.6772	0.6847	0.6923	0.6974	0.7024	(40)
HLP (average)												0.6942	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.1559	(42)
Hot water usage for mixer showers	83.0050	81.7576	79.9399	76.4620	73.8955	71.0332	69.4063	71.2103	73.1878	76.2609	79.8135	82.6870	(42a)
Hot water usage for baths	26.0831	25.6958	25.1503	24.1445	23.3913	22.5562	22.1051	22.6468	23.2366	24.1302	25.1567	25.9950	(42b)
Hot water usage for other uses	36.7088	35.3739	34.0390	32.7042	31.3693	30.0344	30.0344	31.3693	32.7042	34.0390	35.3739	36.7088	(42c)
Average daily hot water use (litres/day)												134.0826	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7969	142.8273	139.1292	133.3107	128.6561	123.6239	121.5459	125.2264	129.1285	134.4302	140.3441	145.3907	(44)
Energy conte	230.9067	203.3841	213.8364	182.4956	173.1958	152.0100	146.9993	155.0565	159.2284	182.4205	199.9459	227.6467	(45)
Energy content (annual)											Total = Sum(45)m =	2227.1258	
Distribution loss (46)m = 0.15 x (45)m	34.6360	30.5076	32.0755	27.3743	25.9794	22.8015	22.0499	23.2585	23.8843	27.3631	29.9919	34.1470	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
										Total per year (kWh/year) = Sum(64)m =		2474.1578	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	93.5611	82.7855	87.8852	76.9230	74.3722	66.7865	65.6619	68.3409	69.1866	77.4394	82.7252	92.4772	(65)

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5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7302	19.3006	15.6963	11.8831	8.8827	7.4992	8.1031	10.5328	14.1371	17.9502	20.9506	22.3341	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.7577	284.6815	277.3137	261.6285	241.8288	223.2199	210.7880	207.8643	215.2321	230.9172	250.7169	269.3258	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	(71)
Water heating gains (Table 5)	125.7542	123.1928	118.1253	106.8375	99.9627	92.7591	88.2552	91.8561	96.0926	104.0853	114.8961	124.2973	(72)
Total internal gains	522.4518	520.3846	504.3451	473.5589	443.8841	416.6880	400.3562	403.4629	418.6715	446.1625	479.7734	509.1670	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(75)
Southeast	11.8100	36.7938	0.6300	0.8270	0.7700	156.8932	(77)

Solar gains	188.9949	332.5911	483.3882	646.4144	767.3690	780.8797	744.9195	651.7680	539.3863	375.2206	228.3142	160.4838	(83)
Total gains	711.4468	852.9757	987.7333	1119.9732	1211.2531	1197.5676	1145.2757	1055.2309	958.0577	821.3831	708.0876	669.6508	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.7745	79.0546	79.3367	80.7780	81.0725	82.5781	82.5781	82.8860	81.9692	81.0725	80.4855	79.9070	
alpha	6.2516	6.2703	6.2891	6.3852	6.4048	6.5052	6.5052	6.5257	6.4646	6.4048	6.3657	6.3271	
util living area	0.9030	0.8075	0.6675	0.4956	0.3527	0.2412	0.1734	0.1960	0.3273	0.5744	0.8198	0.9213	(86)
MIT	20.6897	20.8522	20.9540	20.9930	20.9993	21.0000	21.0000	21.0000	20.9997	20.9866	20.8667	20.6491	(87)
Th 2	20.3298	20.3320	20.3342	20.3454	20.3476	20.3588	20.3588	20.3610	20.3543	20.3476	20.3432	20.3387	(88)
util rest of house	0.8881	0.7855	0.6410	0.4695	0.3281	0.2171	0.1481	0.1688	0.2968	0.5404	0.7950	0.9085	(89)
MIT 2	19.9885	20.1767	20.2890	20.3392	20.3471	20.3588	20.3588	20.3610	20.3541	20.3361	20.2070	19.9486	(90)
Living area fraction										fLA = Living area / (4) =		0.3439	(91)
MIT	20.2297	20.4090	20.5177	20.5640	20.5714	20.5793	20.5793	20.5808	20.5761	20.5598	20.4339	20.1896	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2297	20.4090	20.5177	20.5640	20.5714	20.5793	20.5793	20.5808	20.5761	20.5598	20.4339	20.1896	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8857	0.7881	0.6484	0.4782	0.3365	0.2254	0.1568	0.1782	0.3073	0.5516	0.7986	0.9054	(94)
Useful gains	630.1308	672.2506	640.4892	535.6178	407.6196	269.8816	179.6187	188.0104	294.3932	453.0509	565.4734	606.2927	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	753.7551	731.2498	658.5834	538.2263	407.8736	269.8945	179.6196	188.0124	294.4927	457.9172	617.5145	745.8656	(97)
Space heating kWh	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(98a)
Space heating requirement - total per year (kWh/year)												292.0855	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												292.0855	
Space heating per m2										(98c) / (4) =		4.3982	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5604	10.4416	11.5604	11.1874	11.5604	11.1874	11.5604	11.5604	11.1874	11.5604	11.1874	11.5604	(231)
Lighting	19.0203	15.2588	13.7389	10.0657	7.7750	6.3523	7.0926	9.2193	11.9749	15.7117	17.7464	19.5489	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.9020	-25.1650	-40.7355	-51.2571	-60.2242	-57.9694	-57.0463	-51.4863	-42.0498	-30.6941	-18.2779	-13.4134	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.0531	-7.3297	-16.5280	-27.6662	-38.7205	-39.7876	-39.2248	-31.7520	-21.6853	-11.4048	-4.3848	-2.3228	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

Space heating fuel - main system 1	292.0855	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2474.1578	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.1139	(230a)
Total electricity for the above, kWh/year	136.1139	(231)
Electricity for lighting (calculated in Appendix L)	153.5048	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-708.0805	(233)
Wind generation	0.0000	(234)

Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2347.7816	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	292.0855	16.4900	48.1649	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	16.4900	407.9886	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	136.1139	16.4900	22.4452	(249)
Energy for lighting	153.5048	16.4900	25.3129	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.2208	16.4900	-76.5500	
PV Unit electricity exported	-243.8596	5.5900	-13.6318	
Total			-90.1818	(252)
Total energy cost			413.7299	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.3369	(257)
SAP value		78.3290	
SAP rating (Section 12)		78	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	292.0855	0.1601	46.7656	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2474.1578	0.1413	349.5790	(264)
Space and water heating			396.3446	(265)
Pumps, fans and electric keep-hot	136.1139	0.1387	18.8807	(267)
Energy for lighting	153.5048	0.1443	22.1555	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.2208	0.1323	-61.4360	
PV Unit electricity exported	-243.8596	0.1232	-30.0483	
Total			-91.4843	(269)
Total CO2, kg/year			345.8964	(272)
CO2 emissions per m2			5.2100	(273)
EI value			95.8397	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		66.4100 (1b)	x	2.4000 (2b)	=	159.3840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.4100						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.3840	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.8100	19.6900	25.1200	0.1400	3.5168	14.0000	351.6800	(29a)
Total net area of external elements Aum(A, m2)			44.8100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.8485			(33)
Party Wall 1			55.0200	0.0000	0.0000	20.0000	1100.4000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.4100			80.0000	5312.8000	(32d)
Party Ceiling 1			66.4100			80.0000	5312.8000	(32b)
Internal Wall 1			140.4500			9.0000	1264.0500	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13418.7300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 202.0589 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.5900	0.0700	1.1613
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	21.8000	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.5553 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 31.4038 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.0814	16.0814	15.7461	14.7402	14.5726	13.9020	13.5667	13.5667	14.2373	15.0755	15.4108	15.2432	(38)
Heat transfer coeff	47.4853	47.4853	47.1500	46.1441	45.9764	45.3058	44.9705	44.9705	45.6411	46.4794	46.8147	46.6470	(39)

Average = Sum(39)m / 12 = 46.2558

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7150	0.7150	0.7100	0.6948	0.6923	0.6822	0.6772	0.6772	0.6873	0.6999	0.7049	0.7024	(40)
HLP (average)												0.6965	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1559 (42)
Hot water usage for mixer showers

83.0050	81.7576	79.9399	76.4620	73.8955	71.0332	69.4063	71.2103	73.1878	76.2609	79.8135	82.6870	(42a)

Hot water usage for baths

26.0831	25.6958	25.1503	24.1445	23.3913	22.5562	22.1051	22.6468	23.2366	24.1302	25.1567	25.9950	(42b)

Hot water usage for other uses

36.7088	35.3739	34.0390	32.7042	31.3693	30.0344	30.0344	31.3693	32.7042	34.0390	35.3739	36.7088	(42c)

Average daily hot water use (litres/day) 134.0826 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7969	142.8273	139.1292	133.3107	128.6561	123.6239	121.5459	125.2264	129.1285	134.4302	140.3441	145.3907	(44)
Energy conte	230.9067	203.3841	213.8364	182.4956	173.1958	152.0100	146.9993	155.0565	159.2284	182.4205	199.9459	227.6467	(45)
Energy content (annual)										Total = Sum(45)m =		2227.1258	
Distribution loss (46)m = 0.15 x (45)m	34.6360	30.5076	32.0755	27.3743	25.9794	22.8015	22.0499	23.2585	23.8843	27.3631	29.9919	34.1470	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
									Total per year (kWh/year) = Sum(64)m =		2474.1578	(64)
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

93.5611	82.7855	87.8852	76.9230	74.3722	66.7865	65.6619	68.3409	69.1866	77.4394	82.7252	92.4772	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	21.7302	19.3006	15.6963	11.8831	8.8827	7.4992	8.1031	10.5328	14.1371	17.9502	20.9506	22.3341	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	281.7577	284.6815	277.3137	261.6285	241.8288	223.2199	210.7880	207.8643	215.2321	230.9172	250.7169	269.3258	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	(71)

Water heating gains (Table 5)

	125.7542	123.1928	118.1253	106.8375	99.9627	92.7591	88.2552	91.8561	96.0926	104.0853	114.8961	124.2973	(72)

Total internal gains

	522.4518	520.3846	504.3451	473.5589	443.8841	416.6880	400.3562	403.4629	418.6715	446.1625	479.7734	509.1670	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(75)
Southeast	11.8100	33.4622	0.6300	0.8270	0.7700	142.6869	(77)

Solar gains	171.2264	321.1940	487.0707	684.6820	805.1181	796.7968	769.3033	653.9832	538.3810	359.9515	212.5016	148.7415	(83)
Total gains	693.6782	841.5786	991.4157	1158.2409	1249.0022	1213.4847	1169.6595	1057.4461	957.0525	806.1140	692.2750	657.9085	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.4964	78.4964	79.0546	80.7780	81.0725	82.2725	82.8860	82.8860	81.6681	80.1952	79.6208	79.9070	
alpha	6.2331	6.2331	6.2703	6.3852	6.4048	6.4848	6.5257	6.5257	6.4445	6.3463	6.3081	6.3271	
util living area	0.9197	0.8349	0.7014	0.5179	0.3787	0.2911	0.2345	0.2636	0.3905	0.6359	0.8514	0.9346	(86)
MIT	20.6348	20.8103	20.9354	20.9903	20.9988	20.9998	21.0000	20.9999	20.9989	20.9734	20.8218	20.5957	(87)
Th 2	20.3276	20.3276	20.3320	20.3454	20.3476	20.3566	20.3610	20.3610	20.3521	20.3409	20.3365	20.3387	(88)
util rest of house	0.9069	0.8149	0.6763	0.4930	0.3548	0.2672	0.2100	0.2365	0.3598	0.6026	0.8294	0.9237	(89)
MIT 2	19.9210	20.1249	20.2669	20.3365	20.3466	20.3564	20.3610	20.3610	20.3513	20.3170	20.1505	19.8839	(90)
Living area fraction									fLA = Living area / (4) =			0.3439	(91)
MIT	20.1665	20.3606	20.4968	20.5613	20.5709	20.5777	20.5808	20.5807	20.5740	20.5428	20.3814	20.1287	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1665	20.3606	20.4968	20.5613	20.5709	20.5777	20.5808	20.5807	20.5740	20.5428	20.3814	20.1287	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9035	0.8159	0.6826	0.5012	0.3630	0.2754	0.2184	0.2458	0.3703	0.6129	0.8309	0.9199	(94)
Useful gains	626.7471	686.6584	676.6978	580.5582	453.3870	334.1970	255.4576	259.9424	354.4406	494.0662	575.2427	605.2281	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	772.4183	762.6420	702.3835	584.2461	453.8286	334.2536	255.4673	259.9631	354.8138	503.9653	645.1697	766.3484	(97)
Space heating kWh	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(98a)
Space heating requirement - total per year (kWh/year)												359.1203	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												359.1203	
Space heating per m2										(98c) / (4) =		5.4076	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
Efficiency of water heater												100.0000	(216)

(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5604	10.4416	11.5604	11.1874	11.5604	11.1874	11.5604	11.5604	11.1874	11.5604	11.1874	11.5604	(231)
Lighting	19.0203	15.2588	13.7389	10.0657	7.7750	6.3523	7.0926	9.2193	11.9749	15.7117	17.7464	19.5489	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.4219	-24.2665	-40.8039	-53.4428	-62.3485	-58.8113	-58.3661	-51.5020	-41.7727	-29.4443	-17.0276	-12.4092	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.5668	-6.7960	-16.4400	-29.7978	-41.3079	-40.8915	-40.9673	-31.7699	-21.4298	-10.5575	-3.8409	-2.0189	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	359.1203	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2474.1578	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.1139	(230a)
Total electricity for the above, kWh/year	136.1139	(231)
Electricity for lighting (calculated in Appendix L)	153.5048	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-713.0011	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2409.8957	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	359.1203	25.1600	90.3547	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	25.1600	622.4981	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	136.1139	25.1600	34.2463	(249)
Energy for lighting	153.5048	25.1600	38.6218	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.6169	25.1600	-116.8976	
PV Unit electricity exported	-248.3842	5.8100	-14.4311	
Total			-131.3287	(252)
Total energy cost			654.3921	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	359.1203	0.1596	57.3260	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2474.1578	0.1413	349.5790	(264)
Space and water heating			406.9051	(265)
Pumps, fans and electric keep-hot	136.1139	0.1387	18.8807	(267)
Energy for lighting	153.5048	0.1443	22.1555	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.6169	0.1320	-61.3475	
PV Unit electricity exported	-248.3842	0.1227	-30.4782	
Total			-91.8258	(269)
Total CO2, kg/year			356.1155	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	359.1203	1.5908	571.2751	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	1.5225	3766.8228	(278)
Space and water heating			4338.0979	(279)
Pumps, fans and electric keep-hot	136.1139	1.5128	205.9132	(281)
Energy for lighting	153.5048	1.5338	235.4508	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.6169	1.4879	-691.2826	
PV Unit electricity exported	-248.3842	0.4503	-111.8546	
Total			-803.1371	(283)
Total Primary energy kWh/year			3976.3248	(286)

SAP 10 EPC IMPROVEMENTS

Unit 407 L03_Copy

Current energy efficiency rating: C 78
Current environmental impact rating: A 96

N Solar water heating	Not applicable
U Solar photovoltaic panels	Not applicable
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 78
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£786	£786	£0
Space heating	£125	£125	£0
Water heating	£622	£622	£0
Lighting	£39	£39	£0
Generated (PV)	-£131	-£131	£0
Total cost of fuels	£655	£655	£0
Total cost of uses	£655	£655	£0
Delivered energy	36 kWh/m²	36 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	60 kWh/m²	60 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.4100 (1b)	x	2.4000 (2b)	=	159.3840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.4100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.3840	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.8100	19.6900	25.1200	0.1400	3.5168	14.0000	351.6800	(29a)
Total net area of external elements Aum(A, m2)			44.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.8485			(33)
Party Wall 1			55.0200	0.0000	0.0000	20.0000	1100.4000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.4100			80.0000	5312.8000	(32d)
Party Ceiling 1			66.4100			80.0000	5312.8000	(32b)
Internal Wall 1			140.4500			9.0000	1264.0500	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13418.7300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 202.0589 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240	
E4 Jamb	23.2000	0.0500	1.1600	
E7 Party floor between dwellings (in blocks of flats)	16.5900	0.0700	1.1613	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	21.8000	0.0000	0.0000	
E16 Corner (normal)	5.4000	0.0900	0.4860	
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.5553 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 31.4038 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.9138	15.7461	15.5785	14.7402	14.5726	13.7343	13.7343	13.5667	14.0696	14.5726	14.9079	15.2432	(38)
Heat transfer coeff	47.3176	47.1500	46.9823	46.1441	45.9764	45.1382	45.1382	44.9705	45.4735	45.9764	46.3117	46.6470	(39)
Average = Sum(39)m / 12 =												46.1022	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7125	0.7100	0.7075	0.6948	0.6923	0.6797	0.6797	0.6772	0.6847	0.6923	0.6974	0.7024	(40)
HLP (average)												0.6942	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1559 (42)
Hot water usage for mixer showers

83.0050	81.7576	79.9399	76.4620	73.8955	71.0332	69.4063	71.2103	73.1878	76.2609	79.8135	82.6870	(42a)

Hot water usage for baths

26.0831	25.6958	25.1503	24.1445	23.3913	22.5562	22.1051	22.6468	23.2366	24.1302	25.1567	25.9950	(42b)

Hot water usage for other uses

36.7088	35.3739	34.0390	32.7042	31.3693	30.0344	30.0344	31.3693	32.7042	34.0390	35.3739	36.7088	(42c)

Average daily hot water use (litres/day) 134.0826 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7969	142.8273	139.1292	133.3107	128.6561	123.6239	121.5459	125.2264	129.1285	134.4302	140.3441	145.3907	(44)
Energy conte	230.9067	203.3841	213.8364	182.4956	173.1958	152.0100	146.9993	155.0565	159.2284	182.4205	199.9459	227.6467	(45)
Energy content (annual)										Total = Sum(45)m =		2227.1258	
Distribution loss (46)m = 0.15 x (45)m	34.6360	30.5076	32.0755	27.3743	25.9794	22.8015	22.0499	23.2585	23.8843	27.3631	29.9919	34.1470	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
									Total per year (kWh/year) = Sum(64)m =			2474.1578	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	93.5611	82.7855	87.8852	76.9230	74.3722	66.7865	65.6619	68.3409	69.1866	77.4394	82.7252	92.4772	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7302	19.3006	15.6963	11.8831	8.8827	7.4992	8.1031	10.5328	14.1371	17.9502	20.9506	22.3341	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.7577	284.6815	277.3137	261.6285	241.8288	223.2199	210.7880	207.8643	215.2321	230.9172	250.7169	269.3258	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	(71)
Water heating gains (Table 5)													

	125.7542	123.1928	118.1253	106.8375	99.9627	92.7591	88.2552	91.8561	96.0926	104.0853	114.8961	124.2973	(72)
Total internal gains													
	522.4518	520.3846	504.3451	473.5589	443.8841	416.6880	400.3562	403.4629	418.6715	446.1625	479.7734	509.1670	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(75)
Southeast	11.8100	36.7938	0.6300	0.8270	0.7700	156.8932	(77)

Solar gains	188.9949	332.5911	483.3882	646.4144	767.3690	780.8797	744.9195	651.7680	539.3863	375.2206	228.3142	160.4838	(83)
Total gains	711.4468	852.9757	987.7333	1119.9732	1211.2531	1197.5676	1145.2757	1055.2309	958.0577	821.3831	708.0876	669.6508	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.7745	79.0546	79.3367	80.7780	81.0725	82.5781	82.5781	82.8860	81.9692	81.0725	80.4855	79.9070	
alpha	6.2516	6.2703	6.2891	6.3852	6.4048	6.5052	6.5052	6.5257	6.4646	6.4048	6.3657	6.3271	
util living area													
	0.9030	0.8075	0.6675	0.4956	0.3527	0.2412	0.1734	0.1960	0.3273	0.5744	0.8198	0.9213	(86)
MIT	20.6897	20.8522	20.9540	20.9930	20.9993	21.0000	21.0000	21.0000	20.9997	20.9866	20.8667	20.6491	(87)
Th 2	20.3298	20.3320	20.3342	20.3454	20.3476	20.3588	20.3588	20.3610	20.3543	20.3476	20.3432	20.3387	(88)
util rest of house													
	0.8881	0.7855	0.6410	0.4695	0.3281	0.2171	0.1481	0.1688	0.2968	0.5404	0.7950	0.9085	(89)
MIT 2	19.9885	20.1767	20.2890	20.3392	20.3471	20.3588	20.3588	20.3610	20.3541	20.3361	20.2070	19.9486	(90)
Living area fraction										fLA = Living area / (4) =		0.3439	(91)
MIT	20.2297	20.4090	20.5177	20.5640	20.5714	20.5793	20.5793	20.5808	20.5761	20.5598	20.4339	20.1896	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2297	20.4090	20.5177	20.5640	20.5714	20.5793	20.5793	20.5808	20.5761	20.5598	20.4339	20.1896	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8857	0.7881	0.6484	0.4782	0.3365	0.2254	0.1568	0.1782	0.3073	0.5516	0.7986	0.9054	(94)
Useful gains	630.1308	672.2506	640.4892	535.6178	407.6196	269.8816	179.6187	188.0104	294.3932	453.0509	565.4734	606.2927	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	753.7551	731.2498	658.5834	538.2263	407.8736	269.8945	179.6196	188.0124	294.4927	457.9172	617.5145	745.8656	(97)
Space heating kWh													
	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(98a)
Space heating requirement - total per year (kWh/year)												292.0855	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												292.0855	
Space heating per m2											(98c) / (4) =	4.3982	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5604	10.4416	11.5604	11.1874	11.5604	11.1874	11.5604	11.5604	11.1874	11.5604	11.1874	11.5604	(231)
Lighting	19.0203	15.2588	13.7389	10.0657	7.7750	6.3523	7.0926	9.2193	11.9749	15.7117	17.7464	19.5489	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.9020	-25.1650	-40.7355	-51.2571	-60.2242	-57.9694	-57.0463	-51.4863	-42.0498	-30.6941	-18.2779	-13.4134	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													

(233b)m	-3.0531	-7.3297	-16.5280	-27.6662	-38.7205	-39.7876	-39.2248	-31.7520	-21.6853	-11.4048	-4.3848	-2.3228	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	292.0855	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2474.1578	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.1139	(230a)
Total electricity for the above, kWh/year	136.1139	(231)
Electricity for lighting (calculated in Appendix L)	153.5048	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-708.0805	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2347.7816	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	292.0855	16.4900	48.1649	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	16.4900	407.9886	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	136.1139	16.4900	22.4452	(249)
Energy for lighting	153.5048	16.4900	25.3129	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.2208	16.4900	-76.5500	
PV Unit electricity exported	-243.8596	5.5900	-13.6318	
Total			-90.1818	(252)
Total energy cost			413.7299	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.3369	(257)
SAP value		78.3290	
SAP rating (Section 12)		78	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	292.0855	0.1601	46.7656	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2474.1578	0.1413	349.5790	(264)
Space and water heating			396.3446	(265)
Pumps, fans and electric keep-hot	136.1139	0.1387	18.8807	(267)
Energy for lighting	153.5048	0.1443	22.1555	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.2208	0.1323	-61.4360	
PV Unit electricity exported	-243.8596	0.1232	-30.0483	
Total			-91.4843	(269)
Total CO2, kg/year			345.8964	(272)
CO2 emissions per m2			5.2100	(273)
EI value			95.8397	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		66.4100 (1b)	x	2.4000 (2b)	=	159.3840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.4100						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.3840	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.8100	19.6900	25.1200	0.1400	3.5168	14.0000	351.6800	(29a)
Total net area of external elements Aum(A, m2)			44.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.8485			(33)
Party Wall 1			55.0200	0.0000	0.0000	20.0000	1100.4000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.4100			80.0000	5312.8000	(32d)
Party Ceiling 1			66.4100			80.0000	5312.8000	(32b)
Internal Wall 1			140.4500			9.0000	1264.0500	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13418.7300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.0589 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.5900	0.0700	1.1613
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	21.8000	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.5553 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	31.4038 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.0814	16.0814	15.7461	14.7402	14.5726	13.9020	13.5667	13.5667	14.2373	15.0755	15.4108	15.2432	(38)
Heat transfer coeff	47.4853	47.4853	47.1500	46.1441	45.9764	45.3058	44.9705	44.9705	45.6411	46.4794	46.8147	46.6470	(39)
Average = Sum(39)m / 12 =												46.2558	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7150	0.7150	0.7100	0.6948	0.6923	0.6822	0.6772	0.6772	0.6873	0.6999	0.7049	0.7024	(40)
HLP (average)												0.6965	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1559	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
83.0050	81.7576	79.9399	76.4620	73.8955	71.0332	69.4063	71.2103	73.1878	76.2609	79.8135	82.6870	(42a)

Hot water usage for baths

26.0831	25.6958	25.1503	24.1445	23.3913	22.5562	22.1051	22.6468	23.2366	24.1302	25.1567	25.9950	(42b)

Hot water usage for other uses

36.7088	35.3739	34.0390	32.7042	31.3693	30.0344	30.0344	31.3693	32.7042	34.0390	35.3739	36.7088	(42c)

Average daily hot water use (litres/day)	134.0826 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7969	142.8273	139.1292	133.3107	128.6561	123.6239	121.5459	125.2264	129.1285	134.4302	140.3441	145.3907	(44)
Energy conte	230.9067	203.3841	213.8364	182.4956	173.1958	152.0100	146.9993	155.0565	159.2284	182.4205	199.9459	227.6467	(45)
Energy content (annual)										Total = Sum(45)m =		2227.1258	
Distribution loss (46)m = 0.15 x (45)m	34.6360	30.5076	32.0755	27.3743	25.9794	22.8015	22.0499	23.2585	23.8843	27.3631	29.9919	34.1470	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)

Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
										Total per year (kWh/year) = Sum(64)m =		2474.1578	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	93.5611	82.7855	87.8852	76.9230	74.3722	66.7865	65.6619	68.3409	69.1866	77.4394	82.7252	92.4772	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.7302	19.3006	15.6963	11.8831	8.8827	7.4992	8.1031	10.5328	14.1371	17.9502	20.9506	22.3341	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	281.7577	284.6815	277.3137	261.6285	241.8288	223.2199	210.7880	207.8643	215.2321	230.9172	250.7169	269.3258	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	(71)
Water heating gains (Table 5)													
	125.7542	123.1928	118.1253	106.8375	99.9627	92.7591	88.2552	91.8561	96.0926	104.0853	114.8961	124.2973	(72)
Total internal gains													
	522.4518	520.3846	504.3451	473.5589	443.8841	416.6880	400.3562	403.4629	418.6715	446.1625	479.7734	509.1670	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(75)
Southeast	11.8100	33.4622	0.6300	0.8270	0.7700	142.6869	(77)

Solar gains	171.2264	321.1940	487.0707	684.6820	805.1181	796.7968	769.3033	653.9832	538.3810	359.9515	212.5016	148.7415	(83)
Total gains	693.6782	841.5786	991.4157	1158.2409	1249.0022	1213.4847	1169.6595	1057.4461	957.0525	806.1140	692.2750	657.9085	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.4964	78.4964	79.0546	80.7780	81.0725	82.2725	82.8860	82.8860	81.6681	80.1952	79.6208	79.9070	
alpha	6.2331	6.2331	6.2703	6.3852	6.4048	6.4848	6.5257	6.5257	6.4445	6.3463	6.3081	6.3271	
util living area													
	0.9197	0.8349	0.7014	0.5179	0.3787	0.2911	0.2345	0.2636	0.3905	0.6359	0.8514	0.9346	(86)
MIT	20.6348	20.8103	20.9354	20.9903	20.9988	20.9998	21.0000	20.9999	20.9989	20.9734	20.8218	20.5957	(87)
Th 2	20.3276	20.3276	20.3320	20.3454	20.3476	20.3566	20.3610	20.3610	20.3521	20.3409	20.3365	20.3387	(88)
util rest of house													
	0.9069	0.8149	0.6763	0.4930	0.3548	0.2672	0.2100	0.2365	0.3598	0.6026	0.8294	0.9237	(89)
MIT 2	19.9210	20.1249	20.2669	20.3365	20.3466	20.3564	20.3610	20.3610	20.3513	20.3170	20.1505	19.8839	(90)
Living area fraction										fLA = Living area / (4) =		0.3439	(91)
MIT	20.1665	20.3606	20.4968	20.5613	20.5709	20.5777	20.5808	20.5807	20.5740	20.5428	20.3814	20.1287	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1665	20.3606	20.4968	20.5613	20.5709	20.5777	20.5808	20.5807	20.5740	20.5428	20.3814	20.1287	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9035	0.8159	0.6826	0.5012	0.3630	0.2754	0.2184	0.2458	0.3703	0.6129	0.8309	0.9199	(94)
Useful gains	626.7471	686.6584	676.6978	580.5582	453.3870	334.1970	255.4576	259.9424	354.4406	494.0662	575.2427	605.2281	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	772.4183	762.6420	702.3835	584.2461	453.8286	334.2536	255.4673	259.9631	354.8138	503.9653	645.1697	766.3484	(97)
Space heating kWh													
	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(98a)
Space heating requirement - total per year (kWh/year)												359.1203	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												359.1203	
Space heating per m2											(98c) / (4) =	5.4076	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5604	10.4416	11.5604	11.1874	11.5604	11.1874	11.5604	11.5604	11.1874	11.5604	11.1874	11.5604	(231)
Lighting	19.0203	15.2588	13.7389	10.0657	7.7750	6.3523	7.0926	9.2193	11.9749	15.7117	17.7464	19.5489	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.4219	-24.2665	-40.8039	-53.4428	-62.3485	-58.8113	-58.3661	-51.5020	-41.7727	-29.4443	-17.0276	-12.4092	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.5668	-6.7960	-16.4400	-29.7978	-41.3079	-40.8915	-40.9673	-31.7699	-21.4298	-10.5575	-3.8409	-2.0189	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												359.1203	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2474.1578	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)													
mechanical ventilation fans (SFP = 0.7000)												136.1139	(230a)
Total electricity for the above, kWh/year												136.1139	(231)
Electricity for lighting (calculated in Appendix L)												153.5048	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-713.0011	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2409.8957	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	359.1203	25.1600	90.3547	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	25.1600	622.4981	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	136.1139	25.1600	34.2463	(249)
Energy for lighting	153.5048	25.1600	38.6218	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.6169	25.1600	-116.8976	
PV Unit electricity exported	-248.3842	5.8100	-14.4311	
Total			-131.3287	(252)
Total energy cost			654.3921	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	359.1203	0.1596	57.3260	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2474.1578	0.1413	349.5790	(264)
Space and water heating			406.9051	(265)
Pumps, fans and electric keep-hot	136.1139	0.1387	18.8807	(267)
Energy for lighting	153.5048	0.1443	22.1555	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.6169	0.1320	-61.3475	
PV Unit electricity exported	-248.3842	0.1227	-30.4782	
Total			-91.8258	(269)
Total CO2, kg/year			356.1155	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	359.1203	1.5908	571.2751	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	1.5225	3766.8228	(278)
Space and water heating			4338.0979	(279)
Pumps, fans and electric keep-hot	136.1139	1.5128	205.9132	(281)
Energy for lighting	153.5048	1.5338	235.4508	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.6169	1.4879	-691.2826	
PV Unit electricity exported	-248.3842	0.4503	-111.8546	
Total			-803.1371	(283)
Total Primary energy kWh/year			3976.3248	(286)

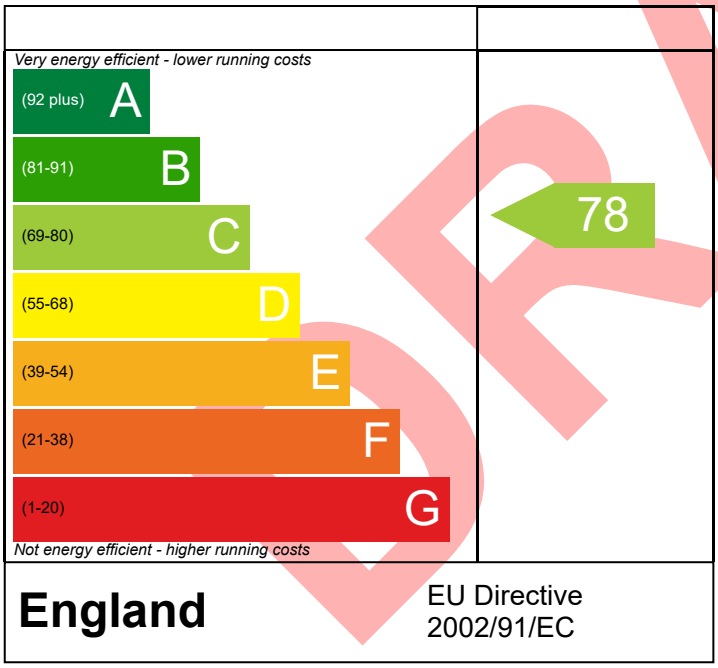
Predicted Energy Assessment

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	66.41 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

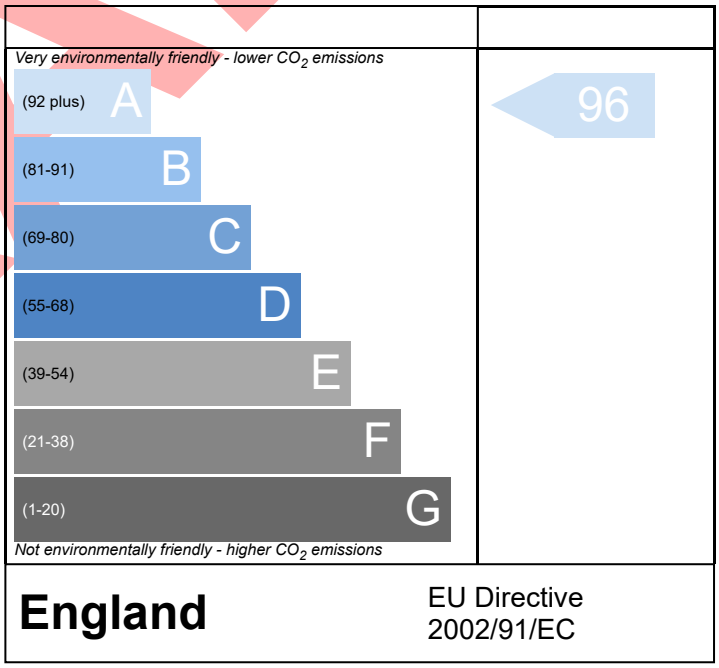
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:26

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	51 m^2
Site Reference	Unit 408 L03_Copy	Plot Reference	Unit 408 L03_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.15 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	5.41 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*60.59 kWh$_{PE}$/m^2*	
Dwelling primary energy	60.93 kWh$_{PE}$/m^2	FAIL
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*12.8 kWh/m^2*	
Dwelling fabric energy efficiency	11.8 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	8.18	0.14 **(!)**
Party wall: Party Wall (1)	46.44	0 **(!)**
Party wall: Party Wall (2)	16.06	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	7.88	South West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.66 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 408 L03_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 408 L03_Copy	**Prop Type Ref**	Unit 408 L03
Property			

SAP Rating	80 C	**DER**	5.41	**TER**	11.15
Environmental	96 A	**% DER < TER**			51.48
CO_2 Emissions (t/year)	0.28	**DFEE**	11.85	**TFEE**	12.80
Compliance Check	See BREL	**% DFEE < TFEE**			7.47
% DPER < TPER	-0.56	**DPER**	60.93	**TPER**	60.59

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.1700	(1b)	x 2.4000	(2b) =	122.8080	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.1700					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		122.8080	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												72.0000	(23c)
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	16.0600	7.8800	8.1800	0.1400	1.1452	14.0000	114.5200	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.8828			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			16.0600	0.0000	0.0000	20.0000	321.2000	(32)
Party Floor 1			51.1700			80.0000	4093.6000	(32d)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			79.3800			9.0000	714.4200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10266.1400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		200.6281 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695

E4 Jamb	9.2800	0.0500	0.4640	
E7 Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.3740 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 12.2568 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.6805	11.5628	11.4450	10.8561	10.7383	10.1494	10.1494	10.0316	10.3850	10.7383	10.9739	11.2094	(38)
Heat transfer coeff	23.9374	23.8196	23.7018	23.1129	22.9951	22.4062	22.4062	22.2885	22.6418	22.9951	23.2307	23.4663	(39)
Average = Sum(39)m / 12 =												23.0835	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4678	0.4655	0.4632	0.4517	0.4494	0.4379	0.4379	0.4356	0.4425	0.4494	0.4540	0.4586	(40)
HLP (average)												0.4511	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7246 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.0608	71.9628	70.3629	67.3017	65.0426	62.5233	61.0913	62.6791	64.4197	67.1247	70.2516	72.7809	(42a)
Hot water usage for baths	22.9731	22.6319	22.1514	21.2656	20.6022	19.8667	19.4694	19.9465	20.4660	21.2530	22.1571	22.8954	(42b)
Hot water usage for other uses	32.2915	31.1172	29.9430	28.7688	27.5945	26.4203	26.4203	27.5945	28.7688	29.9430	31.1172	32.2915	(42c)
Average daily hot water use (litres/day)												118.0151	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.3253	125.7119	122.4573	117.3360	113.2393	108.8102	106.9810	110.2201	113.6544	118.3207	123.5260	127.9677	(44)
Energy conte	203.2359	179.0121	188.2123	160.6271	152.4419	133.7949	129.3842	136.4755	140.1472	160.5600	175.9854	200.3665	(45)
Energy content (annual)										Total = Sum(45)m =		1960.2433	
Distribution loss (46)m = 0.15 x (45)m	30.4854	26.8518	28.2318	24.0941	22.8663	20.0692	19.4076	20.4713	21.0221	24.0840	26.3978	30.0550	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
										Total per year (kWh/year) = Sum(64)m =		2207.2753	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	84.3606	74.6819	79.3652	69.6517	67.4716	60.7300	59.8049	62.1628	62.8422	70.1708	74.7583	83.4065	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.6375	15.6655	12.7400	9.6450	7.2098	6.0868	6.5770	8.5490	11.4745	14.5695	17.0047	18.1277	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	224.2868	226.6142	220.7492	208.2634	192.5023	177.6891	167.7930	165.4656	171.3306	183.8164	199.5774	214.3906	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	(71)
Water heating gains (Table 5)	113.3879	111.1337	106.6737	96.7385	90.6876	84.3472	80.3829	83.5521	87.2808	94.3157	103.8310	112.1055	(72)
Total internal gains	436.8760	434.9772	421.7267	396.2107	371.9635	349.6869	336.3167	339.1305	351.6496	374.2653	401.9770	426.1877	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	104.6841	178.3157	243.9793	302.3022	338.6036	336.1550	324.0893	297.0068	264.1780	197.0768	125.3874	89.5877	(83)
Total gains	541.5600	613.2928	665.7060	698.5129	710.5671	685.8419	660.4060	636.1373	615.8276	571.3421	527.3644	515.7754	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	119.1319	119.7210	120.3159	123.3815	124.0134	127.2729	127.2729	127.9454	125.9487	124.0134	122.7559	121.5237	
alpha	8.9421	8.9814	9.0211	9.2254	9.2676	9.4849	9.4849	9.5297	9.3966	9.2676	9.1837	9.1016	
util living area													
	0.7247	0.6218	0.5156	0.4003	0.3010	0.2091	0.1493	0.1612	0.2537	0.4185	0.6097	0.7476	(86)
MIT	20.9788	20.9938	20.9988	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9999	20.9959	20.9748	(87)
Th 2	20.5504	20.5526	20.5547	20.5653	20.5674	20.5781	20.5781	20.5802	20.5738	20.5674	20.5632	20.5589	(88)
util rest of house													
	0.7074	0.6052	0.4999	0.3860	0.2870	0.1953	0.1350	0.1465	0.2380	0.4011	0.5911	0.7306	(89)
MIT 2	20.5284	20.5463	20.5535	20.5652	20.5674	20.5781	20.5781	20.5802	20.5738	20.5673	20.5592	20.5326	(90)
Living area fraction										fLA = Living area / (4) =		0.5576	(91)
MIT	20.7795	20.7958	20.8017	20.8076	20.8086	20.8133	20.8133	20.8143	20.8114	20.8085	20.8027	20.7792	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7795	20.7958	20.8017	20.8076	20.8086	20.8133	20.8133	20.8143	20.8114	20.8085	20.8027	20.7792	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7163	0.6142	0.5086	0.3940	0.2948	0.2030	0.1429	0.1547	0.2468	0.4108	0.6013	0.7392	(94)
Useful gains	387.8953	376.7106	338.5994	275.1878	209.4519	139.2173	94.4049	98.3874	151.9589	234.7094	317.0931	381.2564	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	394.4762	378.6309	338.9773	275.2187	209.4537	139.2174	94.4049	98.3874	151.9591	234.7458	318.3236	389.0512	(97)
Space heating kWh													
	4.8961	1.2904	0.2812	0.0223	0.0013	0.0000	0.0000	0.0000	0.0000	0.0271	0.8860	5.7993	(98a)
Space heating requirement - total per year (kWh/year)												13.2037	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	4.8961	1.2904	0.2812	0.0223	0.0013	0.0000	0.0000	0.0000	0.0000	0.0271	0.8860	5.7993	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												13.2037	
Space heating per m2											(98c) / (4) =	0.2580	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	4.8961	1.2904	0.2812	0.0223	0.0013	0.0000	0.0000	0.0000	0.0000	0.0271	0.8860	5.7993	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	4.8961	1.2904	0.2812	0.0223	0.0013	0.0000	0.0000	0.0000	0.0000	0.0271	0.8860	5.7993	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9074	8.0454	8.9074	8.6201	8.9074	8.6201	8.9074	8.9074	8.6201	8.9074	8.6201	8.9074	(231)
Lighting	15.4380	12.3850	11.1513	8.1699	6.3107	5.1559	5.7568	7.4829	9.7196	12.7526	14.4040	15.8671	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.1420	-19.3585	-31.6479	-40.1405	-47.3610	-45.6598	-44.9395	-40.4814	-32.9522	-23.8996	-14.0606	-10.2289	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4049	-5.5792	-12.2985	-20.4286	-28.5733	-29.3630	-28.9430	-23.3991	-15.9608	-8.4088	-3.3317	-1.8477	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	13.2037	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2207.2753	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	104.8780	(230a)
Total electricity for the above, kWh/year	104.8780	(231)
Electricity for lighting (calculated in Appendix L)	124.5936	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-543.4106	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1906.5401	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	13.2037	16.4900	2.1773	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	16.4900	363.9797	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	104.8780	16.4900	17.2944	(249)
Energy for lighting	124.5936	16.4900	20.5455	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-362.8720	16.4900	-59.8376	
PV Unit electricity exported	-180.5386	5.5900	-10.0921	
Total			-69.9297	(252)
Total energy cost			334.0672	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2505	(257)
SAP value		79.7288	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	13.2037	0.1616	2.1337	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2207.2753	0.1413	311.7942	(264)
Space and water heating			313.9279	(265)
Pumps, fans and electric keep-hot	104.8780	0.1387	14.5479	(267)
Energy for lighting	124.5936	0.1443	17.9827	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-362.8720	0.1322	-47.9727	
PV Unit electricity exported	-180.5386	0.1235	-22.2897	
Total			-70.2624	(269)
Total CO2, kg/year			276.1961	(272)
CO2 emissions per m2			5.4000	(273)
EI value			96.1516	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		51.1700 (1b)	x	2.4000 (2b)	=	122.8080	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.1700						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	122.8080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	16.0600	7.8800	8.1800	0.1400	1.1452	14.0000	114.5200	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.8828			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			16.0600	0.0000	0.0000	20.0000	321.2000	(32)
Party Floor 1			51.1700			80.0000	4093.6000	(32d)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			79.3800			9.0000	714.4200	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 10266.1400 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 200.6281 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4	Jamb	9.2800	0.0500	0.4640
E7	Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165
E18	Party wall between dwellings	5.4000	0.0600	0.3240
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.3740 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 12.2568 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.7983	11.7983	11.5628	10.8561	10.7383	10.2672	10.0316	10.0316	10.5027	11.0916	11.3272	11.2094	(38)
Heat transfer coeff	24.0552	24.0552	23.8196	23.1129	22.9951	22.5240	22.2885	22.2885	22.7596	23.3485	23.5840	23.4663	(39)

Average = Sum(39)m / 12 = 23.1914

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4701	0.4701	0.4655	0.4517	0.4494	0.4402	0.4356	0.4356	0.4448	0.4563	0.4609	0.4586	(40)
HLP (average)												0.4532	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7246 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.0608	71.9628	70.3629	67.3017	65.0426	62.5233	61.0913	62.6791	64.4197	67.1247	70.2516	72.7809	(42a)
Hot water usage for baths	22.9731	22.6319	22.1514	21.2656	20.6022	19.8667	19.4694	19.9465	20.4660	21.2530	22.1571	22.8954	(42b)
Hot water usage for other uses	32.2915	31.1172	29.9430	28.7688	27.5945	26.4203	26.4203	27.5945	28.7688	29.9430	31.1172	32.2915	(42c)

Average daily hot water use (litres/day) 118.0151 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.3253	125.7119	122.4573	117.3360	113.2393	108.8102	106.9810	110.2201	113.6544	118.3207	123.5260	127.9677	(44)
Energy conte	203.2359	179.0121	188.2123	160.6271	152.4419	133.7949	129.3842	136.4755	140.1472	160.5600	175.9854	200.3665	(45)
Energy content (annual)										Total = Sum(45)m =		1960.2433	
Distribution loss (46)m = 0.15 x (45)m	30.4854	26.8518	28.2318	24.0941	22.8663	20.0692	19.4076	20.4713	21.0221	24.0840	26.3978	30.0550	(46)

Water storage loss:

Store volume 143.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)

Temperature factor from Table 2b 0.6000 (49)

Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
										Total per year (kWh/year) = Sum(64)m =		2207.2753	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	84.3606	74.6819	79.3652	69.6517	67.4716	60.7300	59.8049	62.1628	62.8422	70.1708	74.7583	83.4065	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	17.6375	15.6655	12.7400	9.6450	7.2098	6.0868	6.5770	8.5490	11.4745	14.5695	17.0047	18.1277	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	224.2868	226.6142	220.7492	208.2634	192.5023	177.6891	167.7930	165.4656	171.3306	183.8164	199.5774	214.3906	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	(71)
Water heating gains (Table 5)													
	113.3879	111.1337	106.6737	96.7385	90.6876	84.3472	80.3829	83.5521	87.2808	94.3157	103.8310	112.1055	(72)
Total internal gains													
	436.8760	434.9772	421.7267	396.2107	371.9635	349.6869	336.3167	339.1305	351.6496	374.2653	401.9770	426.1877	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(79)

Solar gains	95.2051	173.0844	247.4999	322.5774	357.6553	345.0938	336.8383	300.1802	265.5901	190.1488	117.1921	83.3220	(83)
Total gains	532.0811	608.0616	669.2266	718.7881	729.6188	694.7807	673.1549	639.3107	617.2397	564.4141	519.1691	509.5097	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	118.5486	118.5486	119.7210	123.3815	124.0134	126.6073	127.9454	127.9454	125.2970	122.1367	120.9168	121.5237	
alpha	8.9032	8.9032	8.9814	9.2254	9.2676	9.4405	9.5297	9.5297	9.3531	9.1424	9.0611	9.1016	
util living area													
	0.7538	0.6550	0.5470	0.4212	0.3246	0.2529	0.2020	0.2162	0.3024	0.4672	0.6492	0.7740	(86)
MIT	20.9702	20.9899	20.9978	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9996	20.9926	20.9661	(87)
Th 2	20.5483	20.5483	20.5526	20.5653	20.5674	20.5760	20.5802	20.5802	20.5717	20.5611	20.5568	20.5589	(88)
util rest of house													
	0.7369	0.6382	0.5313	0.4072	0.3110	0.2391	0.1881	0.2015	0.2866	0.4491	0.6302	0.7576	(89)
MIT 2	20.5170	20.5380	20.5504	20.5651	20.5674	20.5760	20.5802	20.5802	20.5717	20.5607	20.5495	20.5230	(90)
Living area fraction										fLA = Living area / (4) =		0.5576	(91)
MIT	20.7697	20.7900	20.7999	20.8075	20.8086	20.8124	20.8143	20.8143	20.8105	20.8054	20.7965	20.7701	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7697	20.7900	20.7999	20.8075	20.8086	20.8124	20.8143	20.8143	20.8105	20.8054	20.7965	20.7701	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7453	0.6472	0.5400	0.4150	0.3186	0.2468	0.1958	0.2097	0.2954	0.4592	0.6405	0.7655	(94)
Useful gains	396.5380	393.5486	361.3857	298.2777	232.4448	171.4613	131.8200	134.0489	182.3141	259.1802	332.5508	390.0548	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	405.8027	396.6690	362.0545	298.3300	232.4487	171.4615	131.8201	134.0489	182.3155	259.2946	334.8115	400.5712	(97)
Space heating kWh													
	6.8930	2.0969	0.4976	0.0377	0.0029	0.0000	0.0000	0.0000	0.0000	0.0851	1.6276	7.8241	(98a)
Space heating requirement - total per year (kWh/year)												19.0650	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	6.8930	2.0969	0.4976	0.0377	0.0029	0.0000	0.0000	0.0000	0.0000	0.0851	1.6276	7.8241	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												19.0650	
Space heating per m2										(98c) / (4) =		0.3726	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	6.8930	2.0969	0.4976	0.0377	0.0029	0.0000	0.0000	0.0000	0.0000	0.0851	1.6276	7.8241	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	6.8930	2.0969	0.4976	0.0377	0.0029	0.0000	0.0000	0.0000	0.0000	0.0851	1.6276	7.8241	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9074	8.0454	8.9074	8.6201	8.9074	8.6201	8.9074	8.9074	8.6201	8.9074	8.6201	8.9074	(231)

Lighting	15.4380	12.3850	11.1513	8.1699	6.3107	5.1559	5.7568	7.4829	9.7196	12.7526	14.4040	15.8671	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.9944	-18.6173	-31.6417	-41.8588	-49.0561	-46.3351	-45.9986	-40.4939	-32.7321	-22.8868	-13.0643	-9.4500	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.0435	-5.2214	-12.2897	-22.0235	-30.4942	-30.1810	-30.2340	-23.4124	-15.7721	-7.8122	-2.9511	-1.6227	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	19.0650	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2207.2753	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	104.8780	(230a)
Total electricity for the above, kWh/year	104.8780	(231)
Electricity for lighting (calculated in Appendix L)	124.5936	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-547.1869	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1908.6251	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	19.0650	25.1600	4.7968	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	25.1600	555.3505	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	104.8780	25.1600	26.3873	(249)
Energy for lighting	124.5936	25.1600	31.3478	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1291	25.1600	-91.3633	
PV Unit electricity exported	-184.0578	5.8100	-10.6938	
Total			-102.0570	(252)
Total energy cost			515.8253	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	19.0650	0.1612	3.0737	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2207.2753	0.1413	311.7942	(264)
Space and water heating			314.8679	(265)
Pumps, fans and electric keep-hot	104.8780	0.1387	14.5479	(267)
Energy for lighting	124.5936	0.1443	17.9827	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1291	0.1319	-47.8936	
PV Unit electricity exported	-184.0578	0.1230	-22.6361	
Total			-70.5297	(269)
Total CO2, kg/year			276.8688	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	19.0650	1.5966	30.4390	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	1.5223	3360.2168	(278)
Space and water heating			3390.6558	(279)
Pumps, fans and electric keep-hot	104.8780	1.5128	158.6595	(281)
Energy for lighting	124.5936	1.5338	191.1059	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1291	1.4873	-540.0823	
PV Unit electricity exported	-184.0578	0.4513	-83.0740	
Total			-623.1563	(283)
Total Primary energy kWh/year			3117.2649	(286)

SAP 10 EPC IMPROVEMENTS

Unit 408 L03_Copy

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 80
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£618	£618	£0
Space heating	£31	£31	£0
Water heating	£555	£555	£0
Lighting	£31	£31	£0
Generated (PV)	-£102	-£102	£0
Total cost of fuels	£516	£516	£0
Total cost of uses	£515	£515	£0
Delivered energy	37 kWh/m²	37 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	61 kWh/m²	61 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.1700 (1b)	x	2.4000 (2b)	=	122.8080	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.1700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	122.8080	(5)

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2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	16.0600	7.8800	8.1800	0.1400	1.1452	14.0000	114.5200	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.8828			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			16.0600	0.0000	0.0000	20.0000	321.2000	(32)
Party Floor 1			51.1700			80.0000	4093.6000	(32d)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			79.3800			9.0000	714.4200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10266.1400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		200.6281 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.3740 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	12.2568 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.6805	11.5628	11.4450	10.8561	10.7383	10.1494	10.1494	10.0316	10.3850	10.7383	10.9739	11.2094	(38)
Heat transfer coeff	23.9374	23.8196	23.7018	23.1129	22.9951	22.4062	22.4062	22.2885	22.6418	22.9951	23.2307	23.4663	(39)
Average = Sum(39)m / 12 =												23.0835	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4678	0.4655	0.4632	0.4517	0.4494	0.4379	0.4379	0.4356	0.4425	0.4494	0.4540	0.4586	(40)
HLP (average)												0.4511	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.7246 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.0608	71.9628	70.3629	67.3017	65.0426	62.5233	61.0913	62.6791	64.4197	67.1247	70.2516	72.7809	(42a)

Hot water usage for baths

22.9731	22.6319	22.1514	21.2656	20.6022	19.8667	19.4694	19.9465	20.4660	21.2530	22.1571	22.8954	(42b)

Hot water usage for other uses

32.2915	31.1172	29.9430	28.7688	27.5945	26.4203	26.4203	27.5945	28.7688	29.9430	31.1172	32.2915	(42c)

Average daily hot water use (litres/day)		118.0151 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.3253	125.7119	122.4573	117.3360	113.2393	108.8102	106.9810	110.2201	113.6544	118.3207	123.5260	127.9677	(44)
Energy conte	203.2359	179.0121	188.2123	160.6271	152.4419	133.7949	129.3842	136.4755	140.1472	160.5600	175.9854	200.3665	(45)
Energy content (annual)										Total = Sum(45)m =		1960.2433	

Distribution loss (46)m = 0.15 x (45)m

30.4854	26.8518	28.2318	24.0941	22.8663	20.0692	19.4076	20.4713	21.0221	24.0840	26.3978	30.0550	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)

	Total per year (kWh/year) = Sum(64)m =	2207.2753 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000 (64a)

Heat gains from water heating, kWh/month

84.3606	74.6819	79.3652	69.6517	67.4716	60.7300	59.8049	62.1628	62.8422	70.1708	74.7583	83.4065	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.6375	15.6655	12.7400	9.6450	7.2098	6.0868	6.5770	8.5490	11.4745	14.5695	17.0047	18.1277	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	224.2868	226.6142	220.7492	208.2634	192.5023	177.6891	167.7930	165.4656	171.3306	183.8164	199.5774	214.3906	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	(71)
Water heating gains (Table 5)	113.3879	111.1337	106.6737	96.7385	90.6876	84.3472	80.3829	83.5521	87.2808	94.3157	103.8310	112.1055	(72)
Total internal gains	436.8760	434.9772	421.7267	396.2107	371.9635	349.6869	336.3167	339.1305	351.6496	374.2653	401.9770	426.1877	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(79)

Solar gains	104.6841	178.3157	243.9793	302.3022	338.6036	336.1550	324.0893	297.0068	264.1780	197.0768	125.3874	89.5877 (83)
Total gains	541.5600	613.2928	665.7060	698.5129	710.5671	685.8419	660.4060	636.1373	615.8276	571.3421	527.3644	515.7754 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	119.1319	119.7210	120.3159	123.3815	124.0134	127.2729	127.2729	127.9454	125.9487	124.0134	122.7559	121.5237	
alpha	8.9421	8.9814	9.0211	9.2254	9.2676	9.4849	9.4849	9.5297	9.3966	9.2676	9.1837	9.1016	
util living area	0.7247	0.6218	0.5156	0.4003	0.3010	0.2091	0.1493	0.1612	0.2537	0.4185	0.6097	0.7476	(86)
MIT	20.9788	20.9938	20.9988	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9999	20.9959	20.9748	(87)
Th 2	20.5504	20.5526	20.5547	20.5653	20.5674	20.5781	20.5781	20.5802	20.5738	20.5674	20.5632	20.5589	(88)
util rest of house	0.7074	0.6052	0.4999	0.3860	0.2870	0.1953	0.1350	0.1465	0.2380	0.4011	0.5911	0.7306	(89)
MIT 2	20.5284	20.5463	20.5535	20.5652	20.5674	20.5781	20.5781	20.5802	20.5738	20.5673	20.5592	20.5326	(90)
Living area fraction									fLA = Living area / (4) =			0.5576	(91)
MIT	20.7795	20.7958	20.8017	20.8076	20.8086	20.8133	20.8133	20.8143	20.8114	20.8085	20.8027	20.7792	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7795	20.7958	20.8017	20.8076	20.8086	20.8133	20.8133	20.8143	20.8114	20.8085	20.8027	20.7792	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7163	0.6142	0.5086	0.3940	0.2948	0.2030	0.1429	0.1547	0.2468	0.4108	0.6013	0.7392	(94)
Useful gains	387.8953	376.7106	338.5994	275.1878	209.4519	139.2173	94.4049	98.3874	151.9589	234.7094	317.0931	381.2564	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	394.4762	378.6309	338.9773	275.2187	209.4537	139.2174	94.4049	98.3874	151.9591	234.7458	318.3236	389.0512	(97)
Space heating kWh	4.8961	1.2904	0.2812	0.0223	0.0013	0.0000	0.0000	0.0000	0.0000	0.0271	0.8860	5.7993	(98a)
Space heating requirement - total per year (kWh/year)												13.2037	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	4.8961	1.2904	0.2812	0.0223	0.0013	0.0000	0.0000	0.0000	0.0000	0.0271	0.8860	5.7993	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												13.2037	
Space heating per m2											(98c) / (4) =	0.2580	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	4.8961	1.2904	0.2812	0.0223	0.0013	0.0000	0.0000	0.0000	0.0000	0.0271	0.8860	5.7993	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	4.8961	1.2904	0.2812	0.0223	0.0013	0.0000	0.0000	0.0000	0.0000	0.0271	0.8860	5.7993	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9074	8.0454	8.9074	8.6201	8.9074	8.6201	8.9074	8.9074	8.6201	8.9074	8.6201	8.9074	(231)
Lighting	15.4380	12.3850	11.1513	8.1699	6.3107	5.1559	5.7568	7.4829	9.7196	12.7526	14.4040	15.8671	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.1420	-19.3585	-31.6479	-40.1405	-47.3610	-45.6598	-44.9395	-40.4814	-32.9522	-23.8996	-14.0606	-10.2289	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4049	-5.5792	-12.2985	-20.4286	-28.5733	-29.3630	-28.9430	-23.3991	-15.9608	-8.4088	-3.3317	-1.8477	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												13.2037	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2207.2753	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	104.8780	(230a)
Total electricity for the above, kWh/year	104.8780	(231)
Electricity for lighting (calculated in Appendix L)	124.5936	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-543.4106	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1906.5401	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	13.2037	16.4900	2.1773	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	16.4900	363.9797	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	104.8780	16.4900	17.2944	(249)
Energy for lighting	124.5936	16.4900	20.5455	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-362.8720	16.4900	-59.8376	
PV Unit electricity exported	-180.5386	5.5900	-10.0921	
Total			-69.9297	(252)
Total energy cost			334.0672	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2505	(257)
SAP value		79.7288	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	13.2037	0.1616	2.1337	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2207.2753	0.1413	311.7942	(264)
Space and water heating			313.9279	(265)
Pumps, fans and electric keep-hot	104.8780	0.1387	14.5479	(267)
Energy for lighting	124.5936	0.1443	17.9827	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-362.8720	0.1322	-47.9727	
PV Unit electricity exported	-180.5386	0.1235	-22.2897	
Total			-70.2624	(269)
Total CO2, kg/year			276.1961	(272)
CO2 emissions per m2			5.4000	(273)
EI value			96.1516	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		51.1700	(1b)	x 2.4000	(2b) =	122.8080	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.1700						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		122.8080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	16.0600	7.8800	8.1800	0.1400	1.1452	14.0000	114.5200	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	10.8828			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			16.0600	0.0000	0.0000	20.0000	321.2000	(32)
Party Floor 1			51.1700			80.0000	4093.6000	(32d)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			79.3800			9.0000	714.4200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 10266.1400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	200.6281 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	1.3740 (36)
Point Thermal bridges (36a) =	0.0000
Total fabric heat loss (33) + (36) + (36a) =	12.2568 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.7983	11.7983	11.5628	10.8561	10.7383	10.2672	10.0316	10.0316	10.5027	11.0916	11.3272	11.2094	(38)
Heat transfer coeff	24.0552	24.0552	23.8196	23.1129	22.9951	22.5240	22.2885	22.2885	22.7596	23.3485	23.5840	23.4663	(39)
Average = Sum(39)m / 12 =												23.1914	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4701	0.4701	0.4655	0.4517	0.4494	0.4402	0.4356	0.4356	0.4448	0.4563	0.4609	0.4586	(40)
HLP (average)												0.4532	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7246 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.0608	71.9628	70.3629	67.3017	65.0426	62.5233	61.0913	62.6791	64.4197	67.1247	70.2516	72.7809	(42a)
Hot water usage for baths	22.9731	22.6319	22.1514	21.2656	20.6022	19.8667	19.4694	19.9465	20.4660	21.2530	22.1571	22.8954	(42b)
Hot water usage for other uses	32.2915	31.1172	29.9430	28.7688	27.5945	26.4203	26.4203	27.5945	28.7688	29.9430	31.1172	32.2915	(42c)
Average daily hot water use (litres/day)												118.0151	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.3253	125.7119	122.4573	117.3360	113.2393	108.8102	106.9810	110.2201	113.6544	118.3207	123.5260	127.9677	(44)
Energy conte	203.2359	179.0121	188.2123	160.6271	152.4419	133.7949	129.3842	136.4755	140.1472	160.5600	175.9854	200.3665	(45)
Energy content (annual)										Total = Sum(45)m =		1960.2433	
Distribution loss (46)m = 0.15 x (45)m	30.4854	26.8518	28.2318	24.0941	22.8663	20.0692	19.4076	20.4713	21.0221	24.0840	26.3978	30.0550	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
									Total per year (kWh/year) = Sum(64)m =			2207.2753	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	84.3606	74.6819	79.3652	69.6517	67.4716	60.7300	59.8049	62.1628	62.8422	70.1708	74.7583	83.4065	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.6375	15.6655	12.7400	9.6450	7.2098	6.0868	6.5770	8.5490	11.4745	14.5695	17.0047	18.1277	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	224.2868	226.6142	220.7492	208.2634	192.5023	177.6891	167.7930	165.4656	171.3306	183.8164	199.5774	214.3906	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	(71)
Water heating gains (Table 5)	113.3879	111.1337	106.6737	96.7385	90.6876	84.3472	80.3829	83.5521	87.2808	94.3157	103.8310	112.1055	(72)
Total internal gains	436.8760	434.9772	421.7267	396.2107	371.9635	349.6869	336.3167	339.1305	351.6496	374.2653	401.9770	426.1877	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(79)

Solar gains	95.2051	173.0844	247.4999	322.5774	357.6553	345.0938	336.8383	300.1802	265.5901	190.1488	117.1921	83.3220	(83)
Total gains	532.0811	608.0616	669.2266	718.7881	729.6188	694.7807	673.1549	639.3107	617.2397	564.4141	519.1691	509.5097	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	118.5486	118.5486	119.7210	123.3815	124.0134	126.6073	127.9454	127.9454	125.2970	122.1367	120.9168	121.5237	
alpha	8.9032	8.9032	8.9814	9.2254	9.2676	9.4405	9.5297	9.5297	9.3531	9.1424	9.0611	9.1016	
util living area	0.7538	0.6550	0.5470	0.4212	0.3246	0.2529	0.2020	0.2162	0.3024	0.4672	0.6492	0.7740	(86)
MIT	20.9702	20.9899	20.9978	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9996	20.9926	20.9661	(87)
Th 2	20.5483	20.5483	20.5526	20.5653	20.5674	20.5760	20.5802	20.5802	20.5717	20.5611	20.5568	20.5589	(88)
util rest of house	0.7369	0.6382	0.5313	0.4072	0.3110	0.2391	0.1881	0.2015	0.2866	0.4491	0.6302	0.7576	(89)
MIT 2	20.5170	20.5380	20.5504	20.5651	20.5674	20.5760	20.5802	20.5802	20.5717	20.5607	20.5495	20.5230	(90)
Living area fraction										fLA = Living area / (4) =		0.5576	(91)
MIT	20.7697	20.7900	20.7999	20.8075	20.8086	20.8124	20.8143	20.8143	20.8105	20.8054	20.7965	20.7701	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7697	20.7900	20.7999	20.8075	20.8086	20.8124	20.8143	20.8143	20.8105	20.8054	20.7965	20.7701	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7453	0.6472	0.5400	0.4150	0.3186	0.2468	0.1958	0.2097	0.2954	0.4592	0.6405	0.7655	(94)
Useful gains	396.5380	393.5486	361.3857	298.2777	232.4448	171.4613	131.8200	134.0489	182.3141	259.1802	332.5508	390.0548	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	405.8027	396.6690	362.0545	298.3300	232.4487	171.4615	131.8201	134.0489	182.3155	259.2946	334.8115	400.5712	(97)
Space heating kWh	6.8930	2.0969	0.4976	0.0377	0.0029	0.0000	0.0000	0.0000	0.0000	0.0851	1.6276	7.8241	(98a)
Space heating requirement - total per year (kWh/year)												19.0650	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	6.8930	2.0969	0.4976	0.0377	0.0029	0.0000	0.0000	0.0000	0.0000	0.0851	1.6276	7.8241	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												19.0650	
Space heating per m2											(98c) / (4) =	0.3726	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	6.8930	2.0969	0.4976	0.0377	0.0029	0.0000	0.0000	0.0000	0.0000	0.0851	1.6276	7.8241	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													

	6.8930	2.0969	0.4976	0.0377	0.0029	0.0000	0.0000	0.0000	0.0000	0.0851	1.6276	7.8241 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	8.9074	8.0454	8.9074	8.6201	8.9074	8.6201	8.9074	8.9074	8.6201	8.9074	8.6201	8.9074 (231)
Lighting	15.4380	12.3850	11.1513	8.1699	6.3107	5.1559	5.7568	7.4829	9.7196	12.7526	14.4040	15.8671 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-10.9944	-18.6173	-31.6417	-41.8588	-49.0561	-46.3351	-45.9986	-40.4939	-32.7321	-22.8868	-13.0643	-9.4500 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.0435	-5.2214	-12.2897	-22.0235	-30.4942	-30.1810	-30.2340	-23.4124	-15.7721	-7.8122	-2.9511	-1.6227 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	19.0650 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2207.2753 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	104.8780 (230a)
Total electricity for the above, kWh/year	104.8780 (231)
Electricity for lighting (calculated in Appendix L)	124.5936 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-547.1869 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1908.6251 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	19.0650	25.1600	4.7968	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	25.1600	555.3505	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	104.8780	25.1600	26.3873	(249)
Energy for lighting	124.5936	25.1600	31.3478	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1291	25.1600	-91.3633	
PV Unit electricity exported	-184.0578	5.8100	-10.6938	
Total			-102.0570	(252)
Total energy cost			515.8253	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	19.0650	0.1612	3.0737	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2207.2753	0.1413	311.7942	(264)
Space and water heating			314.8679	(265)
Pumps, fans and electric keep-hot	104.8780	0.1387	14.5479	(267)
Energy for lighting	124.5936	0.1443	17.9827	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1291	0.1319	-47.8936	
PV Unit electricity exported	-184.0578	0.1230	-22.6361	
Total			-70.5297	(269)
Total CO2, kg/year			276.8688	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	19.0650	1.5966	30.4390	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	1.5223	3360.2168	(278)
Space and water heating			3390.6558	(279)

Pumps, fans and electric keep-hot	104.8780	1.5128	158.6595 (281)
Energy for lighting	124.5936	1.5338	191.1059 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-363.1291	1.4873	-540.0823
PV Unit electricity exported	-184.0578	0.4513	-83.0740
Total			-623.1563 (283)
Total Primary energy kWh/year			3117.2649 (286)

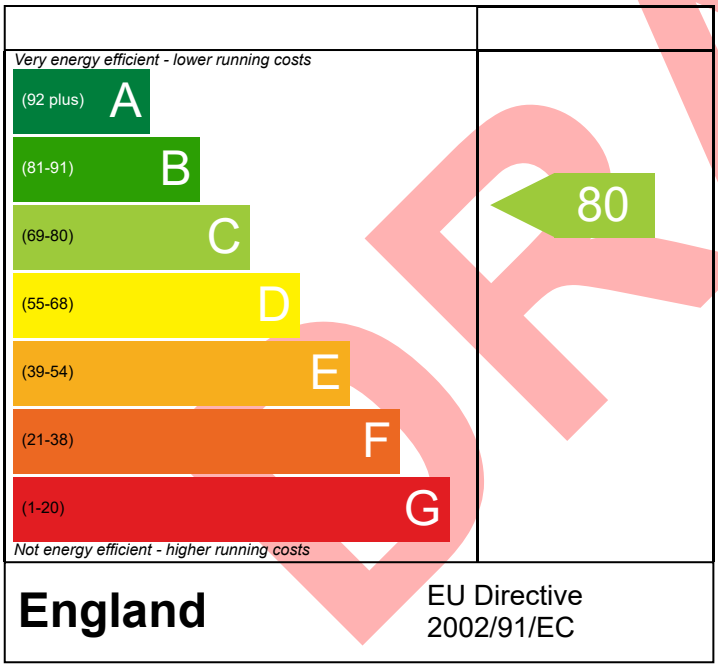
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	51.17 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

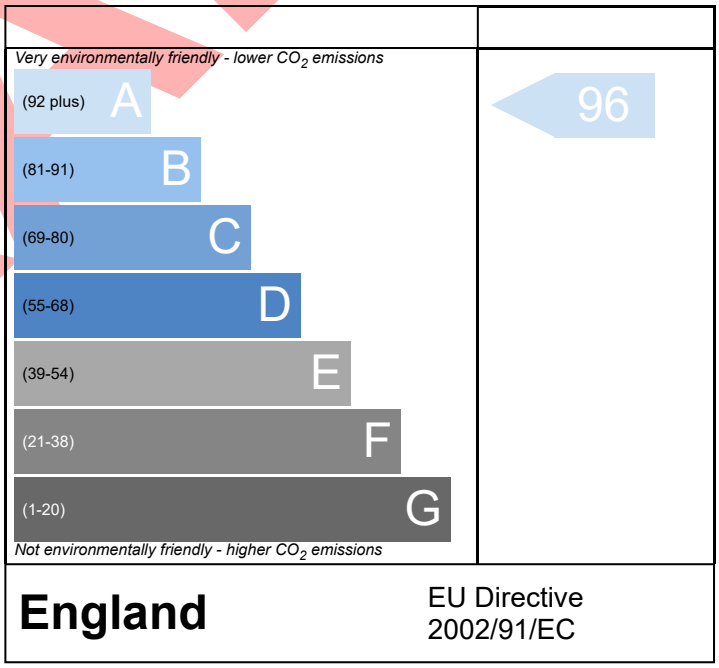
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:26

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	64 m^2
Site Reference	Unit 411 L02_Copy	Plot Reference	Unit 411 L02_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*12.3 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	6.25 kgCO_2/m^2	**OK**
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*66.47 kWh$_{PE}$/m^2*	
Dwelling primary energy	68.78 kWh$_{PE}$/m^2	**FAIL**
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*25.8 kWh/m^2*	
Dwelling fabric energy efficiency	28.7 kWh/m^2	**FAIL**

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	**OK**
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	**OK**
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	21.07	0.14 **(!)**
Party wall: Party Wall (1)	37.53	0 **(!)**
Party wall: Party Wall (2)	6.68	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	7.88	North East	0.83	1.3
N, Opening Type 1	2.11	North	0.83	1.3
NW, Opening Type 1	11.81	North West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.82 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 411 L02_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 411 L02_Copy	**Prop Type Ref**	Unit 411 L02
Property			

SAP Rating	76 C	**DER**	6.25	**TER**	12.30
Environmental	95 A	**% DER < TER**			49.19
CO_2 Emissions (t/year)	0.4	**DFEE**	28.70	**TFEE**	25.80
Compliance Check	See BREL	**% DFEE < TFEE**			-11.22
% DPER < TPER	-3.48	**DPER**	68.78	**TPER**	66.47

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.6600 (1b)	x	2.4000 (2b)	=	152.7840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.6600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	152.7840	(5)

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2. Ventilation rate
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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			21.8000	1.2357	26.9392			(27)
External Wall 1	42.8700	21.8000	21.0700	0.1400	2.9498	14.0000	294.9800	(29a)
Total net area of external elements Aum(A, m2)			42.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.8890			(33)
Party Wall 1			37.5300	0.0000	0.0000	20.0000	750.6000	(32)
Wall to corridor			6.6800	0.0000	0.0000	20.0000	133.6000	(32)
Party Floor 1			63.6600			80.0000	5092.8000	(32d)
Party Ceiling 1			63.6600			80.0000	5092.8000	(32b)
Internal Wall 1			123.2200			9.0000	1108.9800	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12473.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		195.9434 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	9.3800	0.0500	0.4690

E4 Jamb	27.8400	0.0500	1.3920	
E7 Party floor between dwellings (in blocks of flats)	15.8700	0.0700	1.1109	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3700	0.0000	0.0000	
E16 Corner (normal)	5.4000	0.0900	0.4860	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.7819 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 33.6709 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.2548	15.0941	14.9334	14.1298	13.9691	13.1656	13.1656	13.0049	13.4870	13.9691	14.2906	14.6120	(38)
Heat transfer coeff	48.9257	48.7650	48.6043	47.8007	47.6400	46.8365	46.8365	46.6757	47.1579	47.6400	47.9614	48.2828	(39)
Average = Sum(39)m / 12 =												47.7605	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7685	0.7660	0.7635	0.7509	0.7484	0.7357	0.7357	0.7332	0.7408	0.7484	0.7534	0.7584	(40)
HLP (average)												0.7502	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0830 (42)

Hot water usage for mixer showers

81.3240	80.1018	78.3209	74.9135	72.3989	69.5946	68.0007	69.7681	71.7056	74.7165	78.1971	81.0124	(42a)

Hot water usage for baths

25.5574	25.1778	24.6433	23.6578	22.9198	22.1016	21.6596	22.1903	22.7682	23.6438	24.6497	25.4710	(42b)

Hot water usage for other uses

35.9620	34.6543	33.3466	32.0389	30.7312	29.4235	29.4235	30.7312	32.0389	33.3466	34.6543	35.9620	(42c)

Average daily hot water use (litres/day) 131.3665 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	142.8434	139.9340	136.3109	130.6102	126.0499	121.1197	119.0838	122.6897	126.5127	131.7069	137.5011	142.4454	(44)
Energy conte	226.2290	199.2641	209.5047	178.7988	169.6874	148.9308	144.0215	151.9154	156.0028	178.7250	195.8955	223.0351	(45)
Energy content (annual)										Total = Sum(45)m =		2182.0102	
Distribution loss (46)m = 0.15 x (45)m	33.9344	29.8896	31.4257	26.8198	25.4531	22.3396	21.6032	22.7873	23.4004	26.8088	29.3843	33.4553	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
									Total per year (kWh/year) = Sum(64)m =		2429.0422	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

92.0058	81.4156	86.4450	75.6938	73.2057	65.7627	64.6718	67.2965	68.1141	76.2107	81.3784	90.9438	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.9586	18.6152	15.1389	11.4611	8.5673	7.2329	7.8154	10.1588	13.6351	17.3128	20.2066	21.5411	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	271.7527	274.5726	267.4664	252.3383	233.2416	215.2935	203.3031	200.4831	207.5893	222.7175	241.8141	259.7622	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	(71)
Water heating gains (Table 5)	123.6637	121.1542	116.1895	105.1303	98.3948	91.3371	86.9244	90.4523	94.6030	102.4338	113.0256	122.2363	(72)
Total internal gains	507.6160	505.5831	490.0359	460.1707	431.4448	405.1046	389.2840	392.3353	407.0684	433.7051	466.2874	494.7806	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1100	10.6334	0.6300	0.8270	0.7700	8.1009	(74)
Northeast	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(75)
Northwest	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(81)

Solar gains	88.3144	178.7581	320.4794	525.3714	706.3245	753.2685	704.5544	561.4605	390.0832	217.9657	110.9228	72.2597	(83)
Total gains	595.9304	684.3412	810.5153	985.5421	1137.7693	1158.3731	1093.8384	953.7958	797.1516	651.6708	577.2102	567.0403	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.8203	71.0537	71.2887	72.4871	72.7316	73.9794	73.9794	74.2341	73.4752	72.7316	72.2442	71.7632	
alpha	5.7214	5.7369	5.7526	5.8325	5.8488	5.9320	5.9320	5.9489	5.8983	5.8488	5.8163	5.7842	
util living area	0.9495	0.9033	0.7864	0.5758	0.3884	0.2587	0.1884	0.2251	0.4070	0.7170	0.9072	0.9584	(86)
MIT	20.4430	20.6297	20.8505	20.9756	20.9976	20.9998	21.0000	20.9999	20.9978	20.9371	20.6818	20.4051	(87)
Th 2	20.2807	20.2829	20.2851	20.2961	20.2983	20.3094	20.3094	20.3116	20.3050	20.2983	20.2939	20.2895	(88)
util rest of house	0.9400	0.8877	0.7604	0.5448	0.3594	0.2308	0.1588	0.1914	0.3664	0.6785	0.8895	0.9504	(89)
MIT 2	19.6501	19.8768	20.1321	20.2738	20.2964	20.3093	20.3094	20.3116	20.3035	20.2415	19.9531	19.6111	(90)
Living area fraction										fLA = Living area / (4) =		0.3699	(91)
MIT	19.9434	20.1553	20.3979	20.5334	20.5558	20.5647	20.5649	20.5662	20.5604	20.4988	20.2227	19.9048	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9434	20.1553	20.3979	20.5334	20.5558	20.5647	20.5649	20.5662	20.5604	20.4988	20.2227	19.9048	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9350	0.8847	0.7647	0.5553	0.3701	0.2411	0.1698	0.2039	0.3814	0.6898	0.8875	0.9454	(94)
Useful gains	557.2083	605.4138	619.7693	547.3032	421.0875	279.3214	185.6954	194.4496	304.0092	449.5203	512.2933	536.1066	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	765.3659	743.9254	675.4971	556.0856	421.8901	279.3673	185.6996	194.4617	304.6569	471.5806	629.3813	758.2722	(97)
Space heating kWh	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(98a)
Space heating requirement - total per year (kWh/year)												562.3385	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												562.3385	
Space heating per m2										(98c) / (4) =		8.8335	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.0817	10.0092	11.0817	10.7242	11.0817	10.7242	11.0817	11.0817	10.7242	11.0817	10.7242	11.0817	(231)
Lighting	18.3449	14.7170	13.2510	9.7083	7.4989	6.1267	6.8408	8.8919	11.5497	15.1538	17.1162	18.8548	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.3302	-24.3862	-39.3596	-49.2100	-57.7415	-55.5822	-54.6983	-49.3462	-40.2733	-29.5092	-17.6479	-12.9166	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.7432	-6.5971	-15.2405	-26.0425	-36.6010	-37.6280	-37.0950	-30.0206	-20.4973	-10.6316	-3.9607	-2.0877	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	562.3385	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2429.0422	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	130.4775	(230a)
Total electricity for the above, kWh/year	130.4775	(231)
Electricity for lighting (calculated in Appendix L)	148.0540	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-675.1465	(233)
Wind generation	0.0000	(234)

Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2594.7657	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	562.3385	16.4900	92.7296	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	16.4900	400.5491	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	130.4775	16.4900	21.5157	(249)
Energy for lighting	148.0540	16.4900	24.4141	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.0013	16.4900	-73.5456	
PV Unit electricity exported	-229.1452	5.5900	-12.8092	
Total			-86.3548	(252)
Total energy cost			452.8537	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.5003	(257)
SAP value	75.6794	
SAP rating (Section 12)	76	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	562.3385	0.1589	89.3676	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2429.0422	0.1413	343.1917	(264)
Space and water heating			432.5592	(265)
Pumps, fans and electric keep-hot	130.4775	0.1387	18.0988	(267)
Energy for lighting	148.0540	0.1443	21.3688	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.0013	0.1324	-59.0465	
PV Unit electricity exported	-229.1452	0.1229	-28.1599	
Total			-87.2065	(269)
Total CO2, kg/year			384.8203	(272)
CO2 emissions per m2			6.0400	(273)
EI value			95.2544	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.6600 (1b)	x	2.4000 (2b)	=	152.7840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 63.6600						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	152.7840	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			21.8000	1.2357	26.9392			(27)
External Wall 1	42.8700	21.8000	21.0700	0.1400	2.9498	14.0000	294.9800	(29a)
Total net area of external elements Aum(A, m2)			42.8700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.8890			(33)
Party Wall 1			37.5300	0.0000	0.0000	20.0000	750.6000	(32)
Wall to corridor			6.6800	0.0000	0.0000	20.0000	133.6000	(32)
Party Floor 1			63.6600			80.0000	5092.8000	(32d)
Party Ceiling 1			63.6600			80.0000	5092.8000	(32b)
Internal Wall 1			123.2200			9.0000	1108.9800	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12473.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 195.9434 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	9.3800	0.0500	0.4690
E4 Jamb	27.8400	0.0500	1.3920
E7 Party floor between dwellings (in blocks of flats)	15.8700	0.0700	1.1109
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3700	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.7819 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 33.6709 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.4155	15.4155	15.0941	14.1298	13.9691	13.3263	13.0049	13.0049	13.6477	14.4513	14.7727	14.6120	(38)
Heat transfer coeff	49.0864	49.0864	48.7650	47.8007	47.6400	46.9972	46.6757	46.6757	47.3186	48.1221	48.4435	48.2828	(39)
Average = Sum(39)m / 12 =												47.9078	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7711	0.7711	0.7660	0.7509	0.7484	0.7383	0.7332	0.7332	0.7433	0.7559	0.7610	0.7584	(40)
HLP (average)												0.7526	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0830 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	81.3240	80.1018	78.3209	74.9135	72.3989	69.5946	68.0007	69.7681	71.7056	74.7165	78.1971	81.0124	(42a)
Hot water usage for baths	25.5574	25.1778	24.6433	23.6578	22.9198	22.1016	21.6596	22.1903	22.7682	23.6438	24.6497	25.4710	(42b)
Hot water usage for other uses	35.9620	34.6543	33.3466	32.0389	30.7312	29.4235	29.4235	30.7312	32.0389	33.3466	34.6543	35.9620	(42c)
Average daily hot water use (litres/day)												131.3665	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	142.8434	139.9340	136.3109	130.6102	126.0499	121.1197	119.0838	122.6897	126.5127	131.7069	137.5011	142.4454	(44)
Energy conte	226.2290	199.2641	209.5047	178.7988	169.6874	148.9308	144.0215	151.9154	156.0028	178.7250	195.8955	223.0351	(45)
Energy content (annual)										Total = Sum(45)m =		2182.0102	
Distribution loss (46)m = 0.15 x (45)m	33.9344	29.8896	31.4257	26.8198	25.4531	22.3396	21.6032	22.7873	23.4004	26.8088	29.3843	33.4553	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
									Total per year (kWh/year) = Sum(64)m =			2429.0422	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	92.0058	81.4156	86.4450	75.6938	73.2057	65.7627	64.6718	67.2965	68.1141	76.2107	81.3784	90.9438	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	20.9586	18.6152	15.1389	11.4611	8.5673	7.2329	7.8154	10.1588	13.6351	17.3128	20.2066	21.5411	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	271.7527	274.5726	267.4664	252.3383	233.2416	215.2935	203.3031	200.4831	207.5893	222.7175	241.8141	259.7622	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	(71)

Water heating gains (Table 5)

	123.6637	121.1542	116.1895	105.1303	98.3948	91.3371	86.9244	90.4523	94.6030	102.4338	113.0256	122.2363	(72)

Total internal gains

	507.6160	505.5831	490.0359	460.1707	431.4448	405.1046	389.2840	392.3353	407.0684	433.7051	466.2874	494.7806	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1100	9.5462	0.6300	0.8270	0.7700	7.2726	(74)
Northeast	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(75)
Northwest	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(81)

Solar gains	78.5852	169.1438	316.2472	546.8143	731.2676	760.0483	718.8368	554.5515	381.6735	204.7435	101.3144	65.8401	(83)
Total gains	586.2012	674.7269	806.2830	1006.9851	1162.7125	1165.1528	1108.1208	946.8868	788.7419	638.4486	567.6018	560.6207	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.5885	70.5885	71.0537	72.4871	72.7316	73.7264	74.2341	74.2341	73.2256	72.0029	71.5252	71.7632	
alpha	5.7059	5.7059	5.7369	5.8325	5.8488	5.9151	5.9489	5.9489	5.8817	5.8002	5.7683	5.7842	
util living area	0.9573	0.9201	0.8197	0.6065	0.4204	0.3144	0.2569	0.3054	0.4881	0.7768	0.9246	0.9649	(86)
MIT	20.3836	20.5593	20.8002	20.9657	20.9959	20.9994	20.9999	20.9996	20.9932	20.8936	20.6163	20.3459	(87)
Th 2	20.2785	20.2785	20.2829	20.2961	20.2983	20.3072	20.3116	20.3116	20.3027	20.2917	20.2873	20.2895	(88)
util rest of house	0.9492	0.9069	0.7967	0.5771	0.3923	0.2865	0.2279	0.2716	0.4478	0.7427	0.9098	0.9582	(89)
MIT 2	19.5748	19.7882	20.0732	20.2636	20.2949	20.3067	20.3115	20.3114	20.2976	20.1904	19.8693	19.5372	(90)
Living area fraction									fLA = Living area / (4) =			0.3699	(91)
MIT	19.8740	20.0735	20.3421	20.5233	20.5543	20.5630	20.5662	20.5660	20.5549	20.4505	20.1456	19.8364	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8740	20.0735	20.3421	20.5233	20.5543	20.5630	20.5662	20.5660	20.5549	20.4505	20.1456	19.8364	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9440	0.9027	0.7987	0.5867	0.4026	0.2968	0.2386	0.2841	0.4625	0.7507	0.9065	0.9532	(94)
Useful gains	553.3976	609.0788	643.9471	590.8262	468.0629	345.8541	264.4318	269.0226	364.7623	479.2565	514.5178	534.3769	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	784.1055	774.2617	718.8998	603.4044	469.4566	346.0392	264.4719	269.1309	366.9520	517.3378	656.1978	779.1096	(97)
Space heating kWh	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(98a)
Space heating requirement - total per year (kWh/year)												660.9309	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												660.9309	
Space heating per m2											(98c) / (4) =	10.3822	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
Efficiency of water heater												100.0000	(216)

(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.0817	10.0092	11.0817	10.7242	11.0817	10.7242	11.0817	11.0817	10.7242	11.0817	10.7242	11.0817	(231)
Lighting	18.3449	14.7170	13.2510	9.7083	7.4989	6.1267	6.8408	8.8919	11.5497	15.1538	17.1162	18.8548	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-13.8915	-23.5305	-39.5288	-51.3707	-59.7978	-56.3926	-55.9689	-49.3612	-40.0071	-28.3817	-16.4413	-11.9422	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.3070	-6.0873	-15.0525	-27.9982	-39.0374	-38.6728	-38.7444	-30.0375	-20.2557	-9.7595	-3.4566	-1.8147	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	660.9309	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2429.0422	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	130.4775	(230a)
Total electricity for the above, kWh/year	130.4775	(231)
Electricity for lighting (calculated in Appendix L)	148.0540	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-679.8382	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2688.6664	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	660.9309	25.1600	166.2902	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	25.1600	611.1470	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	130.4775	25.1600	32.8281	(249)
Energy for lighting	148.0540	25.1600	37.2504	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.6146	25.1600	-112.3682	
PV Unit electricity exported	-233.2236	5.8100	-13.5503	
Total			-125.9185	(252)
Total energy cost			721.5972	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	660.9309	0.1583	104.6387	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2429.0422	0.1413	343.1917	(264)
Space and water heating			447.8304	(265)
Pumps, fans and electric keep-hot	130.4775	0.1387	18.0988	(267)
Energy for lighting	148.0540	0.1443	21.3688	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.6146	0.1321	-58.9946	
PV Unit electricity exported	-233.2236	0.1224	-28.5364	
Total			-87.5310	(269)
Total CO2, kg/year			399.7670	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	660.9309	1.5860	1048.2442	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	1.5224	3698.0874	(278)
Space and water heating			4746.3316	(279)
Pumps, fans and electric keep-hot	130.4775	1.5128	197.3864	(281)
Energy for lighting	148.0540	1.5338	227.0901	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.6146	1.4881	-664.5888	
PV Unit electricity exported	-233.2236	0.4490	-104.7247	
Total			-769.3135	(283)
Total Primary energy kWh/year			4401.4946	(286)

SAP 10 EPC IMPROVEMENTS

Unit 411 L02_Copy

Current energy efficiency rating: C 76
Current environmental impact rating: A 95

N Solar water heating	Not applicable
U Solar photovoltaic panels	Not applicable
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 76
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£848	£848	£0
Space heating	£199	£199	£0
Water heating	£611	£611	£0
Lighting	£37	£37	£0
Generated (PV)	-£126	-£126	£0
Total cost of fuels	£722	£722	£0
Total cost of uses	£721	£721	£0
Delivered energy	42 kWh/m²	42 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	69 kWh/m²	69 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.6600 (1b)	x	2.4000 (2b)	=	152.7840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.6600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	152.7840	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			21.8000	1.2357	26.9392			(27)
External Wall 1	42.8700	21.8000	21.0700	0.1400	2.9498	14.0000	294.9800	(29a)
Total net area of external elements Aum(A, m2)			42.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.8890			(33)
Party Wall 1			37.5300	0.0000	0.0000	20.0000	750.6000	(32)
Wall to corridor			6.6800	0.0000	0.0000	20.0000	133.6000	(32)
Party Floor 1			63.6600			80.0000	5092.8000	(32d)
Party Ceiling 1			63.6600			80.0000	5092.8000	(32b)
Internal Wall 1			123.2200			9.0000	1108.9800	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12473.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 195.9434 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	9.3800	0.0500	0.4690
E4 Jamb	27.8400	0.0500	1.3920
E7 Party floor between dwellings (in blocks of flats)	15.8700	0.0700	1.1109
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3700	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.7819 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 33.6709 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.2548	15.0941	14.9334	14.1298	13.9691	13.1656	13.1656	13.0049	13.4870	13.9691	14.2906	14.6120	(38)
Heat transfer coeff	48.9257	48.7650	48.6043	47.8007	47.6400	46.8365	46.8365	46.6757	47.1579	47.6400	47.9614	48.2828	(39)

Average = Sum(39)m / 12 = 47.7605

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7685	0.7660	0.7635	0.7509	0.7484	0.7357	0.7357	0.7332	0.7408	0.7484	0.7534	0.7584	(40)
HLP (average)												0.7502	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0830 (42)
Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
81.3240	80.1018	78.3209	74.9135	72.3989	69.5946	68.0007	69.7681	71.7056	74.7165	78.1971	81.0124	(42a)

Hot water usage for baths

25.5574	25.1778	24.6433	23.6578	22.9198	22.1016	21.6596	22.1903	22.7682	23.6438	24.6497	25.4710	(42b)

Hot water usage for other uses

35.9620	34.6543	33.3466	32.0389	30.7312	29.4235	29.4235	30.7312	32.0389	33.3466	34.6543	35.9620	(42c)

Average daily hot water use (litres/day) 131.3665 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	142.8434	139.9340	136.3109	130.6102	126.0499	121.1197	119.0838	122.6897	126.5127	131.7069	137.5011	142.4454	(44)
Energy conte	226.2290	199.2641	209.5047	178.7988	169.6874	148.9308	144.0215	151.9154	156.0028	178.7250	195.8955	223.0351	(45)
Energy content (annual)										Total = Sum(45)m =		2182.0102	
Distribution loss (46)m = 0.15 x (45)m	33.9344	29.8896	31.4257	26.8198	25.4531	22.3396	21.6032	22.7873	23.4004	26.8088	29.3843	33.4553	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
										Total per year (kWh/year) = Sum(64)m =		2429.0422	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	92.0058	81.4156	86.4450	75.6938	73.2057	65.7627	64.6718	67.2965	68.1141	76.2107	81.3784	90.9438	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.9586	18.6152	15.1389	11.4611	8.5673	7.2329	7.8154	10.1588	13.6351	17.3128	20.2066	21.5411	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	271.7527	274.5726	267.4664	252.3383	233.2416	215.2935	203.3031	200.4831	207.5893	222.7175	241.8141	259.7622	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	(71)
Water heating gains (Table 5)	123.6637	121.1542	116.1895	105.1303	98.3948	91.3371	86.9244	90.4523	94.6030	102.4338	113.0256	122.2363	(72)

Total internal gains

	507.6160	505.5831	490.0359	460.1707	431.4448	405.1046	389.2840	392.3353	407.0684	433.7051	466.2874	494.7806 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1100	10.6334	0.6300	0.8270	0.7700	8.1009	(74)
Northeast	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(75)
Northwest	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(81)

Solar gains	88.3144	178.7581	320.4794	525.3714	706.3245	753.2685	704.5544	561.4605	390.0832	217.9657	110.9228	72.2597 (83)
Total gains	595.9304	684.3412	810.5153	985.5421	1137.7693	1158.3731	1093.8384	953.7958	797.1516	651.6708	577.2102	567.0403 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.8203	71.0537	71.2887	72.4871	72.7316	73.9794	73.9794	74.2341	73.4752	72.7316	72.2442	71.7632	
alpha	5.7214	5.7369	5.7526	5.8325	5.8488	5.9320	5.9320	5.9489	5.8983	5.8488	5.8163	5.7842	
util living area	0.9495	0.9033	0.7864	0.5758	0.3884	0.2587	0.1884	0.2251	0.4070	0.7170	0.9072	0.9584	(86)
MIT	20.4430	20.6297	20.8505	20.9756	20.9976	20.9998	21.0000	20.9999	20.9978	20.9371	20.6818	20.4051	(87)
Th 2	20.2807	20.2829	20.2851	20.2961	20.2983	20.3094	20.3094	20.3116	20.3050	20.2983	20.2939	20.2895	(88)
util rest of house	0.9400	0.8877	0.7604	0.5448	0.3594	0.2308	0.1588	0.1914	0.3664	0.6785	0.8895	0.9504	(89)
MIT 2	19.6501	19.8768	20.1321	20.2738	20.2964	20.3093	20.3094	20.3116	20.3035	20.2415	19.9531	19.6111	(90)
Living area fraction									fLA = Living area / (4) =			0.3699	(91)
MIT	19.9434	20.1553	20.3979	20.5334	20.5558	20.5647	20.5649	20.5662	20.5604	20.4988	20.2227	19.9048	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9434	20.1553	20.3979	20.5334	20.5558	20.5647	20.5649	20.5662	20.5604	20.4988	20.2227	19.9048	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9350	0.8847	0.7647	0.5553	0.3701	0.2411	0.1698	0.2039	0.3814	0.6898	0.8875	0.9454	(94)
Useful gains	557.2083	605.4138	619.7693	547.3032	421.0875	279.3214	185.6954	194.4496	304.0092	449.5203	512.2933	536.1066	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	765.3659	743.9254	675.4971	556.0856	421.8901	279.3673	185.6996	194.4617	304.6569	471.5806	629.3813	758.2722	(97)
Space heating kWh	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(98a)
Space heating requirement - total per year (kWh/year)												562.3385	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												562.3385	
Space heating per m2											(98c) / (4) =	8.8335	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	154.8692	93.0798	41.4615	6.3233	0.5971	0.0000	0.0000	0.0000	0.0000	16.4129	84.3034	165.2912	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.0817	10.0092	11.0817	10.7242	11.0817	10.7242	11.0817	11.0817	10.7242	11.0817	10.7242	11.0817	(231)
Lighting	18.3449	14.7170	13.2510	9.7083	7.4989	6.1267	6.8408	8.8919	11.5497	15.1538	17.1162	18.8548	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.3302	-24.3862	-39.3596	-49.2100	-57.7415	-55.5822	-54.6983	-49.3462	-40.2733	-29.5092	-17.6479	-12.9166	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													

(233b)m	-2.7432	-6.5971	-15.2405	-26.0425	-36.6010	-37.6280	-37.0950	-30.0206	-20.4973	-10.6316	-3.9607	-2.0877	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	562.3385	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2429.0422	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	130.4775	(230a)
Total electricity for the above, kWh/year	130.4775	(231)
Electricity for lighting (calculated in Appendix L)	148.0540	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-675.1465	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2594.7657	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	562.3385	16.4900	92.7296	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	16.4900	400.5491	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	130.4775	16.4900	21.5157	(249)
Energy for lighting	148.0540	16.4900	24.4141	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.0013	16.4900	-73.5456	
PV Unit electricity exported	-229.1452	5.5900	-12.8092	
Total			-86.3548	(252)
Total energy cost			452.8537	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.5003	(257)
SAP value		75.6794	
SAP rating (Section 12)		76	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	562.3385	0.1589	89.3676	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2429.0422	0.1413	343.1917	(264)
Space and water heating			432.5592	(265)
Pumps, fans and electric keep-hot	130.4775	0.1387	18.0988	(267)
Energy for lighting	148.0540	0.1443	21.3688	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.0013	0.1324	-59.0465	
PV Unit electricity exported	-229.1452	0.1229	-28.1599	
Total			-87.2065	(269)
Total CO2, kg/year			384.8203	(272)
CO2 emissions per m2			6.0400	(273)
EI value			95.2544	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		63.6600 (1b)	x	2.4000 (2b)	=	152.7840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.6600						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	152.7840	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			21.8000	1.2357	26.9392			(27)
External Wall 1	42.8700	21.8000	21.0700	0.1400	2.9498	14.0000	294.9800	(29a)
Total net area of external elements Aum(A, m2)			42.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.8890			(33)
Party Wall 1			37.5300	0.0000	0.0000	20.0000	750.6000	(32)
Wall to corridor			6.6800	0.0000	0.0000	20.0000	133.6000	(32)
Party Floor 1			63.6600			80.0000	5092.8000	(32d)
Party Ceiling 1			63.6600			80.0000	5092.8000	(32b)
Internal Wall 1			123.2200			9.0000	1108.9800	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12473.7600	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	195.9434	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	9.3800	0.0500	0.4690
E4 Jamb	27.8400	0.0500	1.3920
E7 Party floor between dwellings (in blocks of flats)	15.8700	0.0700	1.1109
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3700	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	3.7819	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	33.6709	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.4155	15.4155	15.0941	14.1298	13.9691	13.3263	13.0049	13.0049	13.6477	14.4513	14.7727	14.6120	(38)
Heat transfer coeff	49.0864	49.0864	48.7650	47.8007	47.6400	46.9972	46.6757	46.6757	47.3186	48.1221	48.4435	48.2828	(39)
Average = Sum(39)m / 12 =												47.9078	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7711	0.7711	0.7660	0.7509	0.7484	0.7383	0.7332	0.7332	0.7433	0.7559	0.7610	0.7584	(40)
HLP (average)												0.7526	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0830	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
81.3240	80.1018	78.3209	74.9135	72.3989	69.5946	68.0007	69.7681	71.7056	74.7165	78.1971	81.0124	(42a)

Hot water usage for baths

25.5574	25.1778	24.6433	23.6578	22.9198	22.1016	21.6596	22.1903	22.7682	23.6438	24.6497	25.4710	(42b)

Hot water usage for other uses

35.9620	34.6543	33.3466	32.0389	30.7312	29.4235	29.4235	30.7312	32.0389	33.3466	34.6543	35.9620	(42c)

Average daily hot water use (litres/day)	131.3665	(43)

Daily hot water use

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
142.8434	139.9340	136.3109	130.6102	126.0499	121.1197	119.0838	122.6897	126.5127	131.7069	137.5011	142.4454	(44)
Energy conte 226.2290	199.2641	209.5047	178.7988	169.6874	148.9308	144.0215	151.9154	156.0028	178.7250	195.8955	223.0351	(45)
Energy content (annual)										Total = Sum(45)m =		2182.0102	

Distribution loss (46)m = 0.15 x (45)m

33.9344	29.8896	31.4257	26.8198	25.4531	22.3396	21.6032	22.7873	23.4004	26.8088	29.3843	33.4553	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

Total storage loss													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
											Total per year (kWh/year) = Sum(64)m =	2429.0422	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000	(64a)
Heat gains from water heating, kWh/month													
	92.0058	81.4156	86.4450	75.6938	73.2057	65.7627	64.6718	67.2965	68.1141	76.2107	81.3784	90.9438	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	124.9802	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.9586	18.6152	15.1389	11.4611	8.5673	7.2329	7.8154	10.1588	13.6351	17.3128	20.2066	21.5411	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	271.7527	274.5726	267.4664	252.3383	233.2416	215.2935	203.3031	200.4831	207.5893	222.7175	241.8141	259.7622	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	49.5810	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	-83.3201	(71)
Water heating gains (Table 5)													
	123.6637	121.1542	116.1895	105.1303	98.3948	91.3371	86.9244	90.4523	94.6030	102.4338	113.0256	122.2363	(72)
Total internal gains													
	507.6160	505.5831	490.0359	460.1707	431.4448	405.1046	389.2840	392.3353	407.0684	433.7051	466.2874	494.7806	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1100	9.5462	0.6300	0.8270	0.7700	7.2726	(74)
Northeast	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(75)
Northwest	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(81)

Solar gains	78.5852	169.1438	316.2472	546.8143	731.2676	760.0483	718.8368	554.5515	381.6735	204.7435	101.3144	65.8401	(83)
Total gains	586.2012	674.7269	806.2830	1006.9851	1162.7125	1165.1528	1108.1208	946.8868	788.7419	638.4486	567.6018	560.6207	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.5885	70.5885	71.0537	72.4871	72.7316	73.7264	74.2341	74.2341	73.2256	72.0029	71.5252	71.7632	
alpha	5.7059	5.7059	5.7369	5.8325	5.8488	5.9151	5.9489	5.9489	5.8817	5.8002	5.7683	5.7842	
util living area													
	0.9573	0.9201	0.8197	0.6065	0.4204	0.3144	0.2569	0.3054	0.4881	0.7768	0.9246	0.9649	(86)
MIT	20.3836	20.5593	20.8002	20.9657	20.9959	20.9994	20.9999	20.9996	20.9932	20.8936	20.6163	20.3459	(87)
Th 2	20.2785	20.2785	20.2829	20.2961	20.2983	20.3072	20.3116	20.3116	20.3027	20.2917	20.2873	20.2895	(88)
util rest of house													
	0.9492	0.9069	0.7967	0.5771	0.3923	0.2865	0.2279	0.2716	0.4478	0.7427	0.9098	0.9582	(89)
MIT 2	19.5748	19.7882	20.0732	20.2636	20.2949	20.3067	20.3115	20.3114	20.2976	20.1904	19.8693	19.5372	(90)
Living area fraction										fLA = Living area / (4) =		0.3699	(91)
MIT	19.8740	20.0735	20.3421	20.5233	20.5543	20.5630	20.5662	20.5660	20.5549	20.4505	20.1456	19.8364	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8740	20.0735	20.3421	20.5233	20.5543	20.5630	20.5662	20.5660	20.5549	20.4505	20.1456	19.8364	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9440	0.9027	0.7987	0.5867	0.4026	0.2968	0.2386	0.2841	0.4625	0.7507	0.9065	0.9532	(94)
Useful gains	553.3976	609.0788	643.9471	590.8262	468.0629	345.8541	264.4318	269.0226	364.7623	479.2565	514.5178	534.3769	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	784.1055	774.2617	718.8998	603.4044	469.4566	346.0392	264.4719	269.1309	366.9520	517.3378	656.1978	779.1096	(97)
Space heating kWh													
	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(98a)
Space heating requirement - total per year (kWh/year)												660.9309	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												660.9309	
Space heating per m2											(98c) / (4) =	10.3822	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	171.6466	111.0029	55.7648	9.0563	1.0370	0.0000	0.0000	0.0000	0.0000	28.3325	102.0096	182.0812	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	247.2098	218.2145	230.4855	199.1028	190.6682	169.2348	165.0023	172.8962	176.3068	199.7058	216.1995	244.0159	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.0817	10.0092	11.0817	10.7242	11.0817	10.7242	11.0817	11.0817	10.7242	11.0817	10.7242	11.0817	(231)
Lighting	18.3449	14.7170	13.2510	9.7083	7.4989	6.1267	6.8408	8.8919	11.5497	15.1538	17.1162	18.8548	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-13.8915	-23.5305	-39.5288	-51.3707	-59.7978	-56.3926	-55.9689	-49.3612	-40.0071	-28.3817	-16.4413	-11.9422	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.3070	-6.0873	-15.0525	-27.9982	-39.0374	-38.6728	-38.7444	-30.0375	-20.2557	-9.7595	-3.4566	-1.8147	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												660.9309	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2429.0422	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)													
mechanical ventilation fans (SFP = 0.7000)												130.4775	(230a)
Total electricity for the above, kWh/year												130.4775	(231)
Electricity for lighting (calculated in Appendix L)												148.0540	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-679.8382	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2688.6664	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	660.9309	25.1600	166.2902	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	25.1600	611.1470	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	130.4775	25.1600	32.8281	(249)
Energy for lighting	148.0540	25.1600	37.2504	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.6146	25.1600	-112.3682	
PV Unit electricity exported	-233.2236	5.8100	-13.5503	
Total			-125.9185	(252)
Total energy cost			721.5972	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	660.9309	0.1583	104.6387	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2429.0422	0.1413	343.1917	(264)
Space and water heating			447.8304	(265)
Pumps, fans and electric keep-hot	130.4775	0.1387	18.0988	(267)
Energy for lighting	148.0540	0.1443	21.3688	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.6146	0.1321	-58.9946	
PV Unit electricity exported	-233.2236	0.1224	-28.5364	
Total			-87.5310	(269)
Total CO2, kg/year			399.7670	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	660.9309	1.5860	1048.2442	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.0422	1.5224	3698.0874	(278)
Space and water heating			4746.3316	(279)
Pumps, fans and electric keep-hot	130.4775	1.5128	197.3864	(281)
Energy for lighting	148.0540	1.5338	227.0901	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-446.6146	1.4881	-664.5888	
PV Unit electricity exported	-233.2236	0.4490	-104.7247	
Total			-769.3135	(283)
Total Primary energy kWh/year			4401.4946	(286)

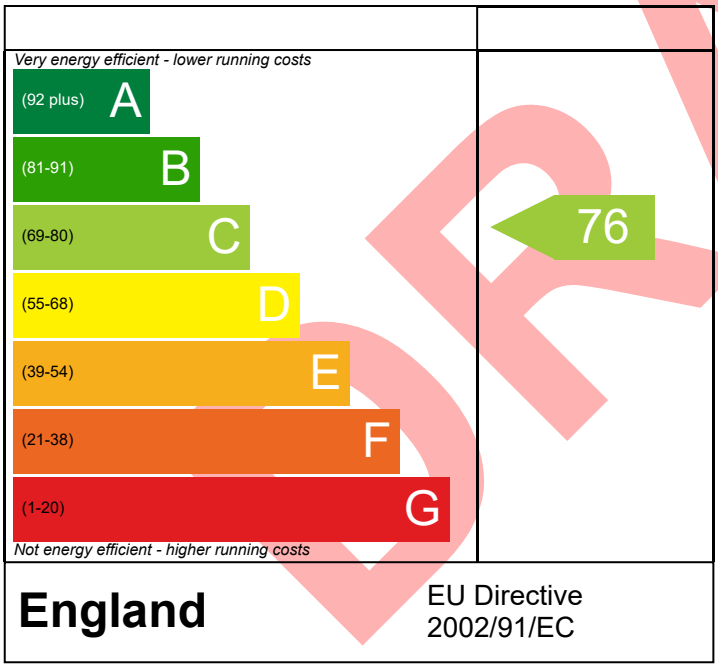
Predicted Energy Assessment

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	63.66 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

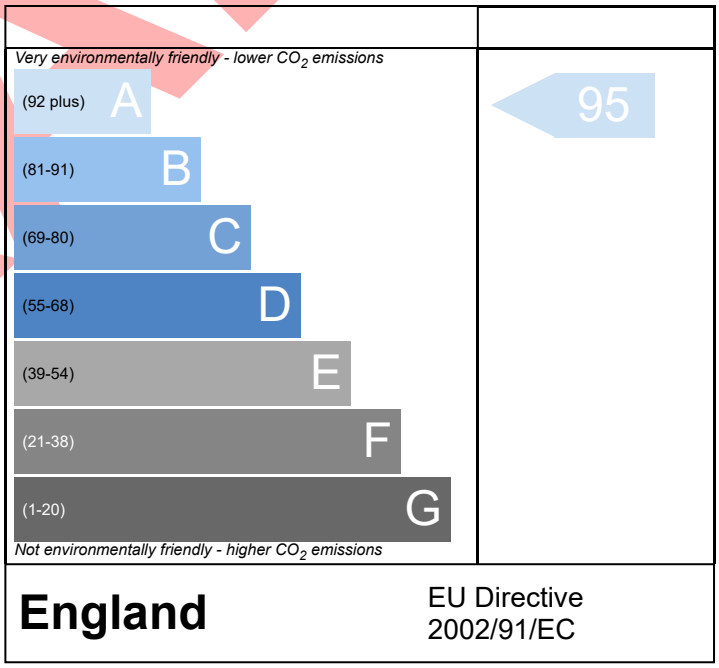
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:27

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	72 m^2
Site Reference	Unit 412 L02_Copy	Plot Reference	Unit 412 L02_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*10.45 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	4.68 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*56.41 kWh$_{PE}$/m^2*	
Dwelling primary energy	52.87 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*18.9 kWh/m^2*	
Dwelling fabric energy efficiency	17.8 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	16.81	0.14 **(!)**
Party wall: Party Wall (1)	41.71	0 **(!)**
Party wall: Party Wall (2)	22.81	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	11.81	North East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.93 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 412 L02_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 412 L02_Copy	**Prop Type Ref**	Unit 412 L02
Property			

SAP Rating	80 C	**DER**	4.68	**TER**	10.45
Environmental	96 A	**% DER < TER**			55.22
CO_2 Emissions (t/year)	0.33	**DFEE**	17.78	**TFEE**	18.90
Compliance Check	See BREL	**% DFEE < TFEE**			5.90
% DPER < TPER	6.27	**DPER**	52.87	**TPER**	56.41

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	71.6800	(1b)	x 2.4000	(2b) =	172.0320	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.6800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		172.0320	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	28.6200	11.8100	16.8100	0.1400	2.3534	14.0000	235.3400	(29a)
Total net area of external elements Aum(A, m2)			28.6200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.9475			(33)
Party Wall 1			41.7100	0.0000	0.0000	20.0000	834.2000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			71.6800			80.0000	5734.4000	(32d)
Party Ceiling 1			71.6800			80.0000	5734.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14231.4100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		198.5409 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545

E4 Jamb	13.9200	0.0500	0.6960	
E7 Party floor between dwellings (in blocks of flats)	10.6000	0.0700	0.7420	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.9000	0.0000	0.0000	
E16 Corner (normal)	2.7000	0.0900	0.2430	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.2595 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 19.2070 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3623	16.1974	16.0324	15.2074	15.0424	14.2175	14.2175	14.0525	14.5475	15.0424	15.3724	15.7024	(38)
Heat transfer coeff	35.5693	35.4044	35.2394	34.4144	34.2494	33.4245	33.4245	33.2595	33.7545	34.2494	34.5794	34.9094	(39)
Average = Sum(39)m / 12 =												34.3732	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4962	0.4939	0.4916	0.4801	0.4778	0.4663	0.4663	0.4640	0.4709	0.4778	0.4824	0.4870	(40)
HLP (average)												0.4795	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2862 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	86.0089	84.7163	82.8328	79.2291	76.5696	73.6038	71.9181	73.7873	75.8363	79.0207	82.7018	85.6793	(42a)
Hot water usage for baths	27.0226	26.6213	26.0561	25.0141	24.2338	23.3686	22.9013	23.4625	24.0735	24.9993	26.0628	26.9312	(42b)
Hot water usage for other uses	38.0431	36.6597	35.2763	33.8929	32.5095	31.1262	31.1262	32.5095	33.8929	35.2763	36.6597	38.0431	(42c)
Average daily hot water use (litres/day)												138.9361	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.0745	147.9973	144.1652	138.1361	133.3130	128.0986	125.9455	129.7594	133.8028	139.2963	145.4243	150.6536	(44)
Energy conte	239.2651	210.7461	221.5766	189.1014	179.4649	157.5122	152.3202	160.6692	164.9922	189.0238	207.1836	235.8872	(45)
Energy content (annual)										Total = Sum(45)m =		2307.7426	
Distribution loss (46)m = 0.15 x (45)m	35.8898	31.6119	33.2365	28.3652	26.9197	23.6268	22.8480	24.1004	24.7488	28.3536	31.0775	35.3831	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)
										Total per year (kWh/year) = Sum(64)m =		2554.7746	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	96.3403	85.2334	90.4589	79.1194	76.4567	68.6160	67.4311	70.2071	71.1031	79.6351	85.1318	95.2171	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.3930	20.7775	16.8974	12.7924	9.5625	8.0730	8.7232	11.3387	15.2188	19.3238	22.5537	24.0432	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	300.2774	303.3934	295.5413	278.8252	257.7241	237.8920	224.6430	221.5270	229.3791	246.0952	267.1963	287.0284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	(71)
Water heating gains (Table 5)	129.4896	126.8354	121.5845	109.8881	102.7644	95.3000	90.6332	94.3644	98.7543	107.0364	118.2386	127.9800	(72)
Total internal gains	549.8877	547.7339	530.7508	498.2333	466.7786	437.9927	420.7271	423.9579	440.0799	469.1831	504.7163	535.7792	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(75)

Solar gains	48.1118	97.9329	176.4440	289.7718	389.5101	415.2590	388.4663	309.6898	214.9998	119.6818	60.5371	39.2905	(83)
Total gains	597.9995	645.6669	707.1948	788.0051	856.2887	853.2517	809.1933	733.6477	655.0797	588.8649	565.2534	575.0697	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	111.1398	111.6577	112.1805	114.8696	115.4229	118.2717	118.2717	118.8584	117.1155	115.4229	114.3215	113.2409	
alpha	8.4093	8.4438	8.4787	8.6580	8.6949	8.8848	8.8848	8.9239	8.8077	8.6949	8.6214	8.5494	
util living area													
	0.8907	0.8306	0.7092	0.5274	0.3719	0.2507	0.1817	0.2085	0.3555	0.6018	0.8105	0.9039	(86)
MIT	20.8722	20.9298	20.9803	20.9984	20.9999	21.0000	21.0000	21.0000	21.0000	20.9963	20.9530	20.8608	(87)
Th 2	20.5243	20.5264	20.5285	20.5391	20.5412	20.5518	20.5518	20.5539	20.5476	20.5412	20.5370	20.5327	(88)
util rest of house													
	0.8771	0.8135	0.6886	0.5076	0.3536	0.2332	0.1632	0.1883	0.3322	0.5761	0.7902	0.8914	(89)
MIT 2	20.3839	20.4516	20.5087	20.5376	20.5412	20.5518	20.5518	20.5539	20.5476	20.5379	20.4887	20.3786	(90)
Living area fraction										fLA = Living area / (4) =		0.4021	(91)
MIT	20.5802	20.6438	20.6983	20.7228	20.7256	20.7320	20.7320	20.7333	20.7295	20.7222	20.6754	20.5725	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5802	20.6438	20.6983	20.7228	20.7256	20.7320	20.7320	20.7333	20.7295	20.7222	20.6754	20.5725	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8788	0.8178	0.6961	0.5155	0.3610	0.2402	0.1707	0.1964	0.3416	0.5863	0.7964	0.8925	(94)
Useful gains	525.5185	528.0545	492.2508	406.2317	309.0939	204.9590	138.1105	144.1228	223.7621	345.2470	450.1599	513.2582	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	579.0763	557.4003	500.3404	406.8764	309.1219	204.9594	138.1105	144.1229	223.7735	346.6793	469.4288	571.5536	(97)
Space heating kWh	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(98a)
Space heating requirement - total per year (kWh/year)												124.3821	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												124.3821	
Space heating per m2											(98c) / (4) =	1.7352	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.2264	11.9464	13.2264	12.7997	13.2264	12.7997	13.2264	13.2264	12.7997	13.2264	12.7997	13.2264	(231)
Lighting	20.4758	16.4264	14.7902	10.8359	8.3700	6.8383	7.6354	9.9247	12.8912	16.9140	19.1043	21.0448	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-17.0008	-26.9528	-43.7049	-55.0326	-64.6365	-62.1981	-61.2076	-55.2744	-45.1885	-33.0016	-19.5873	-14.3353	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.4971	-8.1867	-18.2196	-30.3147	-42.3617	-43.5158	-42.8995	-34.7392	-23.7344	-12.5240	-4.9201	-2.6818	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												124.3821	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2554.7746	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)													
mechanical ventilation fans (SFP = 0.7420)												155.7302	(230a)
Total electricity for the above, kWh/year												155.7302	(231)
Electricity for lighting (calculated in Appendix L)												165.2510	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-765.7149	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)

Appendix Q - special features

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2234.4231	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	124.3821	16.4900	20.5106	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	16.4900	421.2823	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	155.7302	16.4900	25.6799	(249)
Energy for lighting	165.2510	16.4900	27.2499	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.1204	16.4900	-82.1401	
PV Unit electricity exported	-267.5945	5.5900	-14.9585	
Total			-97.0986	(252)
Total energy cost			397.6242	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2268	(257)
SAP value	80.1133	
SAP rating (Section 12)	80	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	124.3821	0.1604	19.9497	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2554.7746	0.1413	360.9927	(264)
Space and water heating			380.9424	(265)
Pumps, fans and electric keep-hot	155.7302	0.1387	21.6017	(267)
Energy for lighting	165.2510	0.1443	23.8508	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.1204	0.1323	-65.9162	
PV Unit electricity exported	-267.5945	0.1234	-33.0212	
Total			-98.9374	(269)
Total CO2, kg/year			327.4575	(272)
CO2 emissions per m2			4.5700	(273)
EI value			96.2393	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	71.6800	(1b)	x 2.4000	(2b) =	172.0320	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 71.6800						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		172.0320	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 = 0.0000	(6a)
Number of open flues	0 * 20 = 0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000	(6d)
Number of flues attached to other heater	0 * 35 = 0.0000	(6e)
Number of blocked chimneys	0 * 20 = 0.0000	(6f)
Number of intermittent extract fans	0 * 10 = 0.0000	(7a)
Number of passive vents	0 * 10 = 0.0000	(7b)
Number of flueless gas fires	0 * 40 = 0.0000	(7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000	(8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	3.0000	(17)
Infiltration rate	0.1500	(18)
Number of sides sheltered	3	(19)
Shelter factor (20) = 1 - [0.075 x (19)] =	0.7750	(20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	28.6200	11.8100	16.8100	0.1400	2.3534	14.0000	235.3400	(29a)
Total net area of external elements Aum(A, m2)			28.6200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.9475			(33)
Party Wall 1			41.7100	0.0000	0.0000	20.0000	834.2000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			71.6800			80.0000	5734.4000	(32d)
Party Ceiling 1			71.6800			80.0000	5734.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14231.4100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 198.5409 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	10.6000	0.0700	0.7420
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.9000	0.0000	0.0000
E16 Corner (normal)	2.7000	0.0900	0.2430

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 0.2595 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 19.2070 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.5273	16.5273	16.1974	15.2074	15.0424	14.3825	14.0525	14.0525	14.7124	15.5374	15.8674	15.7024	(38)
Heat transfer coeff	35.7343	35.7343	35.4044	34.4144	34.2494	33.5895	33.2595	33.2595	33.9195	34.7444	35.0744	34.9094	(39)

Average = Sum(39)m / 12 = 34.5244

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4985	0.4985	0.4939	0.4801	0.4778	0.4686	0.4640	0.4640	0.4732	0.4847	0.4893	0.4870	(40)
HLP (average)												0.4816	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2862 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	86.0089	84.7163	82.8328	79.2291	76.5696	73.6038	71.9181	73.7873	75.8363	79.0207	82.7018	85.6793	(42a)
Hot water usage for baths	27.0226	26.6213	26.0561	25.0141	24.2338	23.3686	22.9013	23.4625	24.0735	24.9993	26.0628	26.9312	(42b)
Hot water usage for other uses	38.0431	36.6597	35.2763	33.8929	32.5095	31.1262	31.1262	32.5095	33.8929	35.2763	36.6597	38.0431	(42c)

Average daily hot water use (litres/day) 138.9361 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.0745	147.9973	144.1652	138.1361	133.3130	128.0986	125.9455	129.7594	133.8028	139.2963	145.4243	150.6536	(44)
Energy conte	239.2651	210.7461	221.5766	189.1014	179.4649	157.5122	152.3202	160.6692	164.9922	189.0238	207.1836	235.8872	(45)

Energy content (annual) Total = Sum(45)m = 2307.7426

Distribution loss (46)m = 0.15 x (45)m	35.8898	31.6119	33.2365	28.3652	26.9197	23.6268	22.8480	24.1004	24.7488	28.3536	31.0775	35.3831	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)

Total per year (kWh/year) = Sum(64)m = 2554.7746 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	96.3403	85.2334	90.4589	79.1194	76.4567	68.6160	67.4311	70.2071	71.1031	79.6351	85.1318	95.2171	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.3930	20.7775	16.8974	12.7924	9.5625	8.0730	8.7232	11.3387	15.2188	19.3238	22.5537	24.0432	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	300.2774	303.3934	295.5413	278.8252	257.7241	237.8920	224.6430	221.5270	229.3791	246.0952	267.1963	287.0284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	(71)
Water heating gains (Table 5)													
	129.4896	126.8354	121.5845	109.8881	102.7644	95.3000	90.6332	94.3644	98.7543	107.0364	118.2386	127.9800	(72)
Total internal gains													
	549.8877	547.7339	530.7508	498.2333	466.7786	437.9927	420.7271	423.9579	440.0799	469.1831	504.7163	535.7792	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(75)

Solar gains	42.7730	92.6022	174.0550	301.5827	403.2921	419.0362	396.3745	305.8819	210.3213	112.3593	55.2465	35.7661	(83)
Total gains	592.6608	640.3361	704.8058	799.8160	870.0707	857.0289	817.1015	729.8397	650.4012	581.5423	559.9628	571.5453	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	110.6266	110.6266	111.6577	114.8696	115.4229	117.6907	118.8584	118.8584	116.5458	113.7786	112.7082	113.2409	
alpha	8.3751	8.3751	8.4438	8.6580	8.6949	8.8460	8.9239	8.9239	8.7697	8.5852	8.5139	8.5494	
util living area													
	0.9065	0.8593	0.7516	0.5619	0.4054	0.3057	0.2483	0.2825	0.4275	0.6674	0.8432	0.9182	(86)
MIT	20.8464	20.9031	20.9677	20.9971	20.9998	21.0000	21.0000	21.0000	20.9998	20.9906	20.9314	20.8348	(87)
Th 2	20.5222	20.5222	20.5264	20.5391	20.5412	20.5497	20.5539	20.5539	20.5455	20.5349	20.5306	20.5327	(88)
util rest of house													
	0.8943	0.8439	0.7321	0.5426	0.3873	0.2881	0.2301	0.2622	0.4039	0.6418	0.8246	0.9073	(89)
MIT 2	20.3514	20.4171	20.4931	20.5364	20.5411	20.5497	20.5539	20.5539	20.5453	20.5262	20.4588	20.3477	(90)
Living area fraction									fLA = Living area / (4) =			0.4021	(91)
MIT	20.5504	20.6125	20.6839	20.7216	20.7255	20.7307	20.7333	20.7333	20.7280	20.7130	20.6488	20.5436	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5504	20.6125	20.6839	20.7216	20.7255	20.7307	20.7333	20.7333	20.7280	20.7130	20.6488	20.5436	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8951	0.8469	0.7387	0.5502	0.3946	0.2951	0.2374	0.2704	0.4134	0.6517	0.8294	0.9075	(94)
Useful gains	530.4783	542.2746	520.6325	440.0970	343.3043	252.9499	194.0117	197.3368	268.8466	378.9737	464.4567	518.6920	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	594.9914	582.9178	534.0374	441.2484	343.3684	252.9535	194.0121	197.3380	268.9149	382.6385	492.7526	587.9989	(97)
Space heating kWh													
	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643	(98a)
Space heating requirement - total per year (kWh/year)												160.8238	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												160.8238	
Space heating per m2										(98c) / (4) =		2.2436	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(219)
Space cooling fuel requirement													

(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.2264	11.9464	13.2264	12.7997	13.2264	12.7997	13.2264	13.2264	12.7997	13.2264	12.7997	13.2264	(231)
Lighting	20.4758	16.4264	14.7902	10.8359	8.3700	6.8383	7.6354	9.9247	12.8912	16.9140	19.1043	21.0448	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.4126	-25.9729	-43.7522	-57.3553	-66.8995	-63.0965	-62.6159	-55.2911	-44.8919	-31.6377	-18.2309	-13.2576	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.9589	-7.6180	-18.1511	-32.6607	-45.1941	-44.7217	-44.8029	-34.7587	-23.4550	-11.6200	-4.3363	-2.3448	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	160.8238	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2554.7746	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	155.7302	(230a)
Total electricity for the above, kWh/year	155.7302	(231)
Electricity for lighting (calculated in Appendix L)	165.2510	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-771.0360	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2265.5437	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	160.8238	25.1600	40.4633	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	25.1600	642.7813	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	155.7302	25.1600	39.1817	(249)
Energy for lighting	165.2510	25.1600	41.5772	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.4140	25.1600	-125.4010	
PV Unit electricity exported	-272.6220	5.8100	-15.8393	
Total			-141.2403	(252)
Total energy cost			622.7632	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	160.8238	0.1598	25.6965	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2554.7746	0.1413	360.9927	(264)
Space and water heating			386.6891	(265)
Pumps, fans and electric keep-hot	155.7302	0.1387	21.6017	(267)
Energy for lighting	165.2510	0.1443	23.8508	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.4140	0.1320	-65.8025	
PV Unit electricity exported	-272.6220	0.1229	-33.5042	
Total			-99.3067	(269)
Total CO2, kg/year			332.8350	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	160.8238	1.5914	255.9292	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	1.5225	3889.6458	(278)
Space and water heating			4145.5750	(279)
Pumps, fans and electric keep-hot	155.7302	1.5128	235.5887	(281)
Energy for lighting	165.2510	1.5338	253.4676	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.4140	1.4878	-741.5395	
PV Unit electricity exported	-272.6220	0.4510	-122.9601	
Total			-864.4997	(283)
Total Primary energy kWh/year			3770.1316	(286)

SAP 10 EPC IMPROVEMENTS

Unit 412 L02_Copy

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N Solar water heating — Not applicable
U Solar photovoltaic panels — Not applicable
V2 Wind turbine — Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 80
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£764	£764	£0
Space heating	£80	£80	£0
Water heating	£643	£643	£0
Lighting	£42	£42	£0
Generated (PV)	-£141	-£141	£0
Total cost of fuels	£623	£623	£0
Total cost of uses	£624	£624	£0
Delivered energy	32 kWh/m²	32 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	53 kWh/m²	53 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	71.6800 (1b)	x	2.4000 (2b)	=	172.0320	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.6800					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	172.0320	(5)

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2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	28.6200	11.8100	16.8100	0.1400	2.3534	14.0000	235.3400	(29a)
Total net area of external elements Aum(A, m2)			28.6200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.9475			(33)
Party Wall 1			41.7100	0.0000	0.0000	20.0000	834.2000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			71.6800			80.0000	5734.4000	(32d)
Party Ceiling 1			71.6800			80.0000	5734.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14231.4100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 198.5409 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	10.6000	0.0700	0.7420
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.9000	0.0000	0.0000
E16 Corner (normal)	2.7000	0.0900	0.2430

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.2595 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 19.2070 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3623	16.1974	16.0324	15.2074	15.0424	14.2175	14.2175	14.0525	14.5475	15.0424	15.3724	15.7024	(38)
Heat transfer coeff	35.5693	35.4044	35.2394	34.4144	34.2494	33.4245	33.4245	33.2595	33.7545	34.2494	34.5794	34.9094	(39)
Average = Sum(39)m / 12 =												34.3732	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4962	0.4939	0.4916	0.4801	0.4778	0.4663	0.4663	0.4640	0.4709	0.4778	0.4824	0.4870	(40)
HLP (average)												0.4795	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2862 (42)
Hot water usage for mixer showers

86.0089	84.7163	82.8328	79.2291	76.5696	73.6038	71.9181	73.7873	75.8363	79.0207	82.7018	85.6793	(42a)

Hot water usage for baths

27.0226	26.6213	26.0561	25.0141	24.2338	23.3686	22.9013	23.4625	24.0735	24.9993	26.0628	26.9312	(42b)

Hot water usage for other uses

38.0431	36.6597	35.2763	33.8929	32.5095	31.1262	31.1262	32.5095	33.8929	35.2763	36.6597	38.0431	(42c)

Average daily hot water use (litres/day) 138.9361 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.0745	147.9973	144.1652	138.1361	133.3130	128.0986	125.9455	129.7594	133.8028	139.2963	145.4243	150.6536	(44)
Energy conte	239.2651	210.7461	221.5766	189.1014	179.4649	157.5122	152.3202	160.6692	164.9922	189.0238	207.1836	235.8872	(45)
Energy content (annual)										Total = Sum(45)m =		2307.7426	
Distribution loss (46)m = 0.15 x (45)m	35.8898	31.6119	33.2365	28.3652	26.9197	23.6268	22.8480	24.1004	24.7488	28.3536	31.0775	35.3831	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)

Total per year (kWh/year) = Sum(64)m = 2554.7746 (64)
Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month

96.3403	85.2334	90.4589	79.1194	76.4567	68.6160	67.4311	70.2071	71.1031	79.6351	85.1318	95.2171	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.3930	20.7775	16.8974	12.7924	9.5625	8.0730	8.7232	11.3387	15.2188	19.3238	22.5537	24.0432	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	300.2774	303.3934	295.5413	278.8252	257.7241	237.8920	224.6430	221.5270	229.3791	246.0952	267.1963	287.0284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	(71)
Water heating gains (Table 5)	129.4896	126.8354	121.5845	109.8881	102.7644	95.3000	90.6332	94.3644	98.7543	107.0364	118.2386	127.9800	(72)
Total internal gains	549.8877	547.7339	530.7508	498.2333	466.7786	437.9927	420.7271	423.9579	440.0799	469.1831	504.7163	535.7792	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(75)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	48.1118	97.9329	176.4440	289.7718	389.5101	415.2590	388.4663	309.6898	214.9998	119.6818	60.5371	39.2905	(83)
Total gains	597.9995	645.6669	707.1948	788.0051	856.2887	853.2517	809.1933	733.6477	655.0797	588.8649	565.2534	575.0697	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	111.1398	111.6577	112.1805	114.8696	115.4229	118.2717	118.2717	118.8584	117.1155	115.4229	114.3215	113.2409	
alpha	8.4093	8.4438	8.4787	8.6580	8.6949	8.8848	8.8848	8.9239	8.8077	8.6949	8.6214	8.5494	
util living area	0.8907	0.8306	0.7092	0.5274	0.3719	0.2507	0.1817	0.2085	0.3555	0.6018	0.8105	0.9039	(86)
MIT	20.8722	20.9298	20.9803	20.9984	20.9999	21.0000	21.0000	21.0000	21.0000	20.9963	20.9530	20.8608	(87)
Th 2	20.5243	20.5264	20.5285	20.5391	20.5412	20.5518	20.5518	20.5539	20.5476	20.5412	20.5370	20.5327	(88)
util rest of house	0.8771	0.8135	0.6886	0.5076	0.3536	0.2332	0.1632	0.1883	0.3322	0.5761	0.7902	0.8914	(89)
MIT 2	20.3839	20.4516	20.5087	20.5376	20.5412	20.5518	20.5518	20.5539	20.5476	20.5379	20.4887	20.3786	(90)
Living area fraction										fLA = Living area / (4) =		0.4021	(91)
MIT	20.5802	20.6438	20.6983	20.7228	20.7256	20.7320	20.7320	20.7333	20.7295	20.7222	20.6754	20.5725	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5802	20.6438	20.6983	20.7228	20.7256	20.7320	20.7320	20.7333	20.7295	20.7222	20.6754	20.5725	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8788	0.8178	0.6961	0.5155	0.3610	0.2402	0.1707	0.1964	0.3416	0.5863	0.7964	0.8925	(94)
Useful gains	525.5185	528.0545	492.2508	406.2317	309.0939	204.9590	138.1105	144.1228	223.7621	345.2470	450.1599	513.2582	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	579.0763	557.4003	500.3404	406.8764	309.1219	204.9594	138.1105	144.1229	223.7735	346.6793	469.4288	571.5536	(97)
Space heating kWh	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(98a)
Space heating requirement - total per year (kWh/year)												124.3821	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												124.3821	
Space heating per m2										(98c) / (4) =		1.7352	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	39.8470	19.7203	6.0187	0.4641	0.0209	0.0000	0.0000	0.0000	0.0000	1.0656	13.8736	43.3718	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.2264	11.9464	13.2264	12.7997	13.2264	12.7997	13.2264	13.2264	12.7997	13.2264	12.7997	13.2264	(231)
Lighting	20.4758	16.4264	14.7902	10.8359	8.3700	6.8383	7.6354	9.9247	12.8912	16.9140	19.1043	21.0448	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-17.0008	-26.9528	-43.7049	-55.0326	-64.6365	-62.1981	-61.2076	-55.2744	-45.1885	-33.0016	-19.5873	-14.3353	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.4971	-8.1867	-18.2196	-30.3147	-42.3617	-43.5158	-42.8995	-34.7392	-23.7344	-12.5240	-4.9201	-2.6818	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	124.3821	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2554.7746	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	155.7302	(230a)
Total electricity for the above, kWh/year	155.7302	(231)
Electricity for lighting (calculated in Appendix L)	165.2510	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-765.7149	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2234.4231	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	124.3821	16.4900	20.5106	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	16.4900	421.2823	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	155.7302	16.4900	25.6799	(249)
Energy for lighting	165.2510	16.4900	27.2499	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.1204	16.4900	-82.1401	
PV Unit electricity exported	-267.5945	5.5900	-14.9585	
Total			-97.0986	(252)
Total energy cost			397.6242	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2268	(257)
SAP value		80.1133	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	124.3821	0.1604	19.9497	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2554.7746	0.1413	360.9927	(264)
Space and water heating			380.9424	(265)
Pumps, fans and electric keep-hot	155.7302	0.1387	21.6017	(267)
Energy for lighting	165.2510	0.1443	23.8508	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.1204	0.1323	-65.9162	
PV Unit electricity exported	-267.5945	0.1234	-33.0212	
Total			-98.9374	(269)
Total CO2, kg/year			327.4575	(272)
CO2 emissions per m2			4.5700	(273)
EI value			96.2393	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	71.6800	(1b)	x 2.4000	(2b) =	172.0320	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 71.6800						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		172.0320	(5)

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2. Ventilation rate

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m3 per hour

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	28.6200	11.8100	16.8100	0.1400	2.3534	14.0000	235.3400	(29a)
Total net area of external elements Aum(A, m2)			28.6200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.9475			(33)
Party Wall 1			41.7100	0.0000	0.0000	20.0000	834.2000	(32)
Wall to corridor			22.8100	0.0000	0.0000	20.0000	456.2000	(32)
Party Floor 1			71.6800			80.0000	5734.4000	(32d)
Party Ceiling 1			71.6800			80.0000	5734.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14231.4100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		198.5409 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	10.6000	0.0700	0.7420
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.9000	0.0000	0.0000
E16 Corner (normal)	2.7000	0.0900	0.2430

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		2.2595 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	19.2070 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.5273	16.5273	16.1974	15.2074	15.0424	14.3825	14.0525	14.0525	14.7124	15.5374	15.8674	15.7024	(38)
Heat transfer coeff	35.7343	35.7343	35.4044	34.4144	34.2494	33.5895	33.2595	33.2595	33.9195	34.7444	35.0744	34.9094	(39)
Average = Sum(39)m / 12 =												34.5244	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4985	0.4985	0.4939	0.4801	0.4778	0.4686	0.4640	0.4640	0.4732	0.4847	0.4893	0.4870	(40)
HLP (average)												0.4816	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.2862 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
86.0089	84.7163	82.8328	79.2291	76.5696	73.6038	71.9181	73.7873	75.8363	79.0207	82.7018	85.6793	(42a)

Hot water usage for baths

27.0226	26.6213	26.0561	25.0141	24.2338	23.3686	22.9013	23.4625	24.0735	24.9993	26.0628	26.9312	(42b)

Hot water usage for other uses

38.0431	36.6597	35.2763	33.8929	32.5095	31.1262	31.1262	32.5095	33.8929	35.2763	36.6597	38.0431	(42c)

Average daily hot water use (litres/day)	138.9361 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.0745	147.9973	144.1652	138.1361	133.3130	128.0986	125.9455	129.7594	133.8028	139.2963	145.4243	150.6536	(44)
Energy conte	239.2651	210.7461	221.5766	189.1014	179.4649	157.5122	152.3202	160.6692	164.9922	189.0238	207.1836	235.8872	(45)
Energy content (annual)											Total = Sum(45)m =	2307.7426	

Distribution loss (46)m = 0.15 x (45)m

35.8898	31.6119	33.2365	28.3652	26.9197	23.6268	22.8480	24.1004	24.7488	28.3536	31.0775	35.3831	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680 (64)
										Total per year (kWh/year) = Sum(64)m =		2554.7746 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000 (64a)
Heat gains from water heating, kWh/month												
	96.3403	85.2334	90.4589	79.1194	76.4567	68.6160	67.4311	70.2071	71.1031	79.6351	85.1318	95.2171 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	137.1726	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.3930	20.7775	16.8974	12.7924	9.5625	8.0730	8.7232	11.3387	15.2188	19.3238	22.5537	24.0432	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	300.2774	303.3934	295.5413	278.8252	257.7241	237.8920	224.6430	221.5270	229.3791	246.0952	267.1963	287.0284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	51.0035	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	-91.4484	(71)
Water heating gains (Table 5)													
	129.4896	126.8354	121.5845	109.8881	102.7644	95.3000	90.6332	94.3644	98.7543	107.0364	118.2386	127.9800	(72)
Total internal gains													
	549.8877	547.7339	530.7508	498.2333	466.7786	437.9927	420.7271	423.9579	440.0799	469.1831	504.7163	535.7792	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(75)

Solar gains	42.7730	92.6022	174.0550	301.5827	403.2921	419.0362	396.3745	305.8819	210.3213	112.3593	55.2465	35.7661	(83)
Total gains	592.6608	640.3361	704.8058	799.8160	870.0707	857.0289	817.1015	729.8397	650.4012	581.5423	559.9628	571.5453	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	110.6266	110.6266	111.6577	114.8696	115.4229	117.6907	118.8584	118.8584	116.5458	113.7786	112.7082	113.2409	
alpha	8.3751	8.3751	8.4438	8.6580	8.6949	8.8460	8.9239	8.9239	8.7697	8.5852	8.5139	8.5494	
util living area													
	0.9065	0.8593	0.7516	0.5619	0.4054	0.3057	0.2483	0.2825	0.4275	0.6674	0.8432	0.9182	(86)
MIT	20.8464	20.9031	20.9677	20.9971	20.9998	21.0000	21.0000	21.0000	20.9998	20.9906	20.9314	20.8348	(87)
Th 2	20.5222	20.5222	20.5264	20.5391	20.5412	20.5497	20.5539	20.5539	20.5455	20.5349	20.5306	20.5327	(88)
util rest of house													
	0.8943	0.8439	0.7321	0.5426	0.3873	0.2881	0.2301	0.2622	0.4039	0.6418	0.8246	0.9073	(89)
MIT 2	20.3514	20.4171	20.4931	20.5364	20.5411	20.5497	20.5539	20.5539	20.5453	20.5262	20.4588	20.3477	(90)
Living area fraction										fLA = Living area / (4) =		0.4021	(91)
MIT	20.5504	20.6125	20.6839	20.7216	20.7255	20.7307	20.7333	20.7333	20.7280	20.7130	20.6488	20.5436	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5504	20.6125	20.6839	20.7216	20.7255	20.7307	20.7333	20.7333	20.7280	20.7130	20.6488	20.5436	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8951	0.8469	0.7387	0.5502	0.3946	0.2951	0.2374	0.2704	0.4134	0.6517	0.8294	0.9075	(94)
Useful gains	530.4783	542.2746	520.6325	440.0970	343.3043	252.9499	194.0117	197.3368	268.8466	378.9737	464.4567	518.6920	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	594.9914	582.9178	534.0374	441.2484	343.3684	252.9535	194.0121	197.3380	268.9149	382.6385	492.7526	587.9989	(97)
Space heating kWh													
	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643	(98a)
Space heating requirement - total per year (kWh/year)												160.8238	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												160.8238	
Space heating per m2											(98c) / (4) =	2.2436	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement												

	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643 (98)
Space heating efficiency (main heating system 1)												
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)												
	47.9977	27.3122	9.9732	0.8290	0.0477	0.0000	0.0000	0.0000	0.0000	2.7266	20.3730	51.5643 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	260.2459	229.6965	242.5574	209.4054	200.4457	177.8162	173.3010	181.6500	185.2962	210.0046	227.4876	256.8680 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	13.2264	11.9464	13.2264	12.7997	13.2264	12.7997	13.2264	13.2264	12.7997	13.2264	12.7997	13.2264 (231)
Lighting	20.4758	16.4264	14.7902	10.8359	8.3700	6.8383	7.6354	9.9247	12.8912	16.9140	19.1043	21.0448 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-15.4126	-25.9729	-43.7522	-57.3553	-66.8995	-63.0965	-62.6159	-55.2911	-44.8919	-31.6377	-18.2309	-13.2576 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.9589	-7.6180	-18.1511	-32.6607	-45.1941	-44.7217	-44.8029	-34.7587	-23.4550	-11.6200	-4.3363	-2.3448 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	160.8238 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2554.7746 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	155.7302 (230a)
Total electricity for the above, kWh/year	155.7302 (231)
Electricity for lighting (calculated in Appendix L)	165.2510 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-771.0360 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2265.5437 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	160.8238	25.1600	40.4633	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	25.1600	642.7813	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	155.7302	25.1600	39.1817	(249)
Energy for lighting	165.2510	25.1600	41.5772	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.4140	25.1600	-125.4010	
PV Unit electricity exported	-272.6220	5.8100	-15.8393	
Total			-141.2403	(252)
Total energy cost			622.7632	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	160.8238	0.1598	25.6965	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2554.7746	0.1413	360.9927	(264)
Space and water heating			386.6891	(265)
Pumps, fans and electric keep-hot	155.7302	0.1387	21.6017	(267)
Energy for lighting	165.2510	0.1443	23.8508	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.4140	0.1320	-65.8025	
PV Unit electricity exported	-272.6220	0.1229	-33.5042	
Total			-99.3067	(269)
Total CO2, kg/year			332.8350	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	

Space heating - main system 1	160.8238	1.5914	255.9292	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.7746	1.5225	3889.6458	(278)
Space and water heating			4145.5750	(279)
Pumps, fans and electric keep-hot	155.7302	1.5128	235.5887	(281)
Energy for lighting	165.2510	1.5338	253.4676	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-498.4140	1.4878	-741.5395	
PV Unit electricity exported	-272.6220	0.4510	-122.9601	
Total			-864.4997	(283)
Total Primary energy kWh/year			3770.1316	(286)

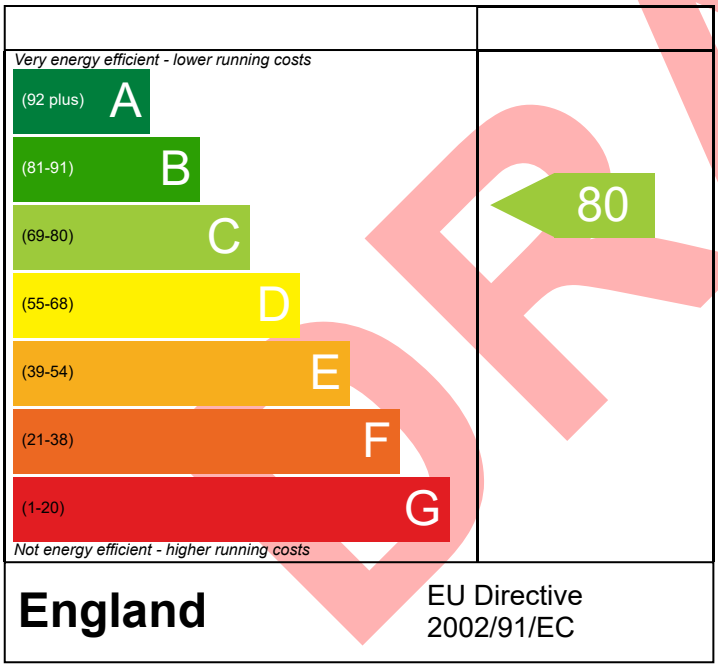
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	71.68 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

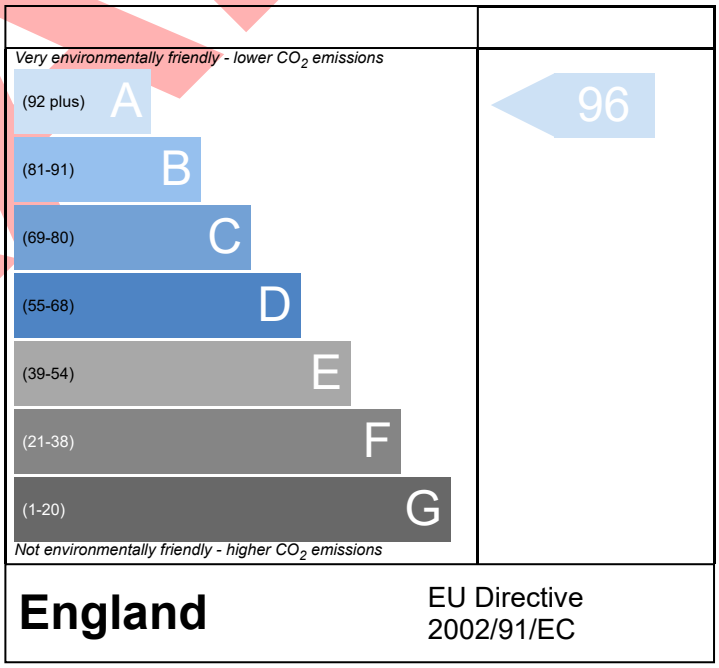
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:27

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	51 m^2
Site Reference	Unit 413 L02_Copy	Plot Reference	Unit 413 L02_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.04 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	5.4 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*60.15 kWh$_{PE}$/m^2*	
Dwelling primary energy	60.84 kWh$_{PE}$/m^2	FAIL
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*11.7 kWh/m^2*	
Dwelling fabric energy efficiency	10.6 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	10.01	0.14 **(!)**
Party wall: Party Wall (1)	46.44	0 **(!)**
Party wall: Party Wall (2)	16.06	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	6.05	South West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.66 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 413 L02_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 413 L02_Copy	**Prop Type Ref**	Unit 413 L02
Property			

SAP Rating	80 C	**DER**	5.40	**TER**	11.04
Environmental	96 A	**% DER < TER**			51.09
CO_2 Emissions (t/year)	0.28	**DFEE**	10.56	**TFEE**	11.66
Compliance Check	See BREL	**% DFEE < TFEE**			9.46
% DPER < TPER	-1.15	**DPER**	60.84	**TPER**	60.15

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.1700	(1b)	x 2.4000	(2b) =	122.8080	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.1700					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		122.8080	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.0500	1.2357	7.4762			(27)
External Wall 1	16.0600	6.0500	10.0100	0.1400	1.4014	14.0000	140.1400	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		8.8776			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			16.0600	0.0000	0.0000	20.0000	321.2000	(32)
Party Floor 1			51.1700			80.0000	4093.6000	(32d)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			79.3800			9.0000	714.4200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10291.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		201.1288 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.6000	0.0500	0.1300

E4 Jamb	9.2800	0.0500	0.4640	
E7 Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.3345 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 10.2121 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.6805	11.5628	11.4450	10.8561	10.7383	10.1494	10.1494	10.0316	10.3850	10.7383	10.9739	11.2094	(38)
Heat transfer coeff	21.8927	21.7749	21.6571	21.0682	20.9504	20.3615	20.3615	20.2437	20.5971	20.9504	21.1860	21.4216	(39)
Average = Sum(39)m / 12 =												21.0388	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4278	0.4255	0.4232	0.4117	0.4094	0.3979	0.3979	0.3956	0.4025	0.4094	0.4140	0.4186	(40)
HLP (average)												0.4112	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7246 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.0608	71.9628	70.3629	67.3017	65.0426	62.5233	61.0913	62.6791	64.4197	67.1247	70.2516	72.7809	(42a)
Hot water usage for baths	22.9731	22.6319	22.1514	21.2656	20.6022	19.8667	19.4694	19.9465	20.4660	21.2530	22.1571	22.8954	(42b)
Hot water usage for other uses	32.2915	31.1172	29.9430	28.7688	27.5945	26.4203	26.4203	27.5945	28.7688	29.9430	31.1172	32.2915	(42c)
Average daily hot water use (litres/day)												118.0151	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.3253	125.7119	122.4573	117.3360	113.2393	108.8102	106.9810	110.2201	113.6544	118.3207	123.5260	127.9677	(44)
Energy conte	203.2359	179.0121	188.2123	160.6271	152.4419	133.7949	129.3842	136.4755	140.1472	160.5600	175.9854	200.3665	(45)
Energy content (annual)										Total = Sum(45)m =		1960.2433	
Distribution loss (46)m = 0.15 x (45)m	30.4854	26.8518	28.2318	24.0941	22.8663	20.0692	19.4076	20.4713	21.0221	24.0840	26.3978	30.0550	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
										Total per year (kWh/year) = Sum(64)m =		2207.2753	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	84.3606	74.6819	79.3652	69.6517	67.4716	60.7300	59.8049	62.1628	62.8422	70.1708	74.7583	83.4065	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.5665	16.4906	13.4111	10.1530	7.5895	6.4074	6.9234	8.9993	12.0789	15.3369	17.9004	19.0825	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	224.2868	226.6142	220.7492	208.2634	192.5023	177.6891	167.7930	165.4656	171.3306	183.8164	199.5774	214.3906	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	(71)
Water heating gains (Table 5)	113.3879	111.1337	106.6737	96.7385	90.6876	84.3472	80.3829	83.5521	87.2808	94.3157	103.8310	112.1055	(72)
Total internal gains	437.8050	435.8023	422.3978	396.7187	372.3432	350.0075	336.6631	339.5808	352.2540	375.0327	402.8727	427.1425	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	6.0500	36.7938	0.6300	0.8270	0.7700	80.3729	(79)

Solar gains	80.3729	136.9048	187.3191	232.0975	259.9685	258.0886	248.8249	228.0319	202.8270	151.3090	96.2682	68.7825	(83)
Total gains	518.1779	572.7071	609.7169	628.8162	632.3117	608.0961	585.4880	567.6127	555.0810	526.3417	499.1409	495.9250	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	130.5835	131.2898	132.0039	135.6936	136.4565	140.4031	140.4031	141.2200	138.7974	136.4565	134.9393	133.4554	
alpha	9.7056	9.7527	9.8003	10.0462	10.0971	10.3602	10.3602	10.4147	10.2532	10.0971	9.9960	9.8970	
util living area													
	0.6984	0.6101	0.5147	0.4054	0.3081	0.2143	0.1530	0.1641	0.2560	0.4139	0.5887	0.7171	(86)
MIT	20.9890	20.9967	20.9993	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9999	20.9982	20.9875	(87)
Th 2	20.5874	20.5896	20.5917	20.6024	20.6045	20.6153	20.6153	20.6174	20.6110	20.6045	20.6003	20.5960	(88)
util rest of house													
	0.6823	0.5950	0.5003	0.3921	0.2950	0.2014	0.1396	0.1504	0.2416	0.3982	0.5721	0.7013	(89)
MIT 2	20.5761	20.5862	20.5910	20.6024	20.6045	20.6153	20.6153	20.6174	20.6110	20.6045	20.5985	20.5829	(90)
Living area fraction										fLA = Living area / (4) =		0.5576	(91)
MIT	20.8063	20.8150	20.8187	20.8240	20.8250	20.8298	20.8298	20.8307	20.8279	20.8250	20.8213	20.8085	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.8063	20.8150	20.8187	20.8240	20.8250	20.8298	20.8298	20.8307	20.8279	20.8250	20.8213	20.8085	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6909	0.6033	0.5083	0.3995	0.3023	0.2086	0.1471	0.1580	0.2496	0.4070	0.5813	0.7096	(94)
Useful gains	357.9877	345.5238	309.8992	251.2030	191.1725	126.8478	86.1248	89.6946	138.5746	214.2033	290.1524	351.9190	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	361.3675	346.5482	310.1013	251.2180	191.1733	126.8478	86.1248	89.6946	138.5747	214.2178	290.7000	355.7795	(97)
Space heating kWh													
	2.5146	0.6884	0.1504	0.0108	0.0006	0.0000	0.0000	0.0000	0.0000	0.0108	0.3943	2.8722	(98a)
Space heating requirement - total per year (kWh/year)												6.6421	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	2.5146	0.6884	0.1504	0.0108	0.0006	0.0000	0.0000	0.0000	0.0000	0.0108	0.3943	2.8722	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6.6421	
Space heating per m2											(98c) / (4) =	0.1298	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	2.5146	0.6884	0.1504	0.0108	0.0006	0.0000	0.0000	0.0000	0.0000	0.0108	0.3943	2.8722	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	2.5146	0.6884	0.1504	0.0108	0.0006	0.0000	0.0000	0.0000	0.0000	0.0108	0.3943	2.8722	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9074	8.0454	8.9074	8.6201	8.9074	8.6201	8.9074	8.9074	8.6201	8.9074	8.6201	8.9074	(231)
Lighting	16.2512	13.0373	11.7386	8.6002	6.6431	5.4274	6.0600	7.8770	10.2315	13.4243	15.1627	16.7028	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.1380	-19.3589	-31.6538	-40.1502	-47.3719	-45.6699	-44.9508	-40.4933	-32.9629	-23.9064	-14.0617	-10.2247	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4089	-5.5789	-12.2926	-20.4189	-28.5624	-29.3529	-28.9317	-23.3873	-15.9501	-8.4020	-3.3306	-1.8520	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	6.6421	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2207.2753	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	104.8780	(230a)
Total electricity for the above, kWh/year	104.8780	(231)
Electricity for lighting (calculated in Appendix L)	131.1561	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-543.4106	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1906.5410	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	6.6421	16.4900	1.0953	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	16.4900	363.9797	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	104.8780	16.4900	17.2944	(249)
Energy for lighting	131.1561	16.4900	21.6276	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-362.9424	16.4900	-59.8492	
PV Unit electricity exported	-180.4682	5.5900	-10.0882	
Total			-69.9374	(252)
Total energy cost			334.0596	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2505	(257)
SAP value	79.7292	
SAP rating (Section 12)	80	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6.6421	0.1617	1.0738	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2207.2753	0.1413	311.7942	(264)
Space and water heating			312.8681	(265)
Pumps, fans and electric keep-hot	104.8780	0.1387	14.5479	(267)
Energy for lighting	131.1561	0.1443	18.9299	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-362.9424	0.1322	-47.9814	
PV Unit electricity exported	-180.4682	0.1235	-22.2818	
Total			-70.2632	(269)
Total CO2, kg/year			276.0827	(272)
CO2 emissions per m2			5.4000	(273)
EI value			96.1532	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		51.1700 (1b)	x	2.4000 (2b)	=	122.8080	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.1700						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	122.8080	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.0500	1.2357	7.4762			(27)
External Wall 1	16.0600	6.0500	10.0100	0.1400	1.4014	14.0000	140.1400	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		8.8776			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			16.0600	0.0000	0.0000	20.0000	321.2000	(32)
Party Floor 1			51.1700			80.0000	4093.6000	(32d)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			79.3800			9.0000	714.4200	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 10291.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 201.1288 (35)
List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	2.6000	0.0500	0.1300
E4	Jamb	9.2800	0.0500	0.4640
E7	Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165
E18	Party wall between dwellings	5.4000	0.0600	0.3240
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.3345 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 10.2121 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.7983	11.7983	11.5628	10.8561	10.7383	10.2672	10.0316	10.0316	10.5027	11.0916	11.3272	11.2094	(38)
Heat transfer coeff	22.0105	22.0105	21.7749	21.0682	20.9504	20.4793	20.2437	20.2437	20.7149	21.3038	21.5393	21.4216	(39)

Average = Sum(39)m / 12 = 21.1467

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4301	0.4301	0.4255	0.4117	0.4094	0.4002	0.3956	0.3956	0.4048	0.4163	0.4209	0.4186	(40)
HLP (average)												0.4133	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7246 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.0608	71.9628	70.3629	67.3017	65.0426	62.5233	61.0913	62.6791	64.4197	67.1247	70.2516	72.7809	(42a)
Hot water usage for baths	22.9731	22.6319	22.1514	21.2656	20.6022	19.8667	19.4694	19.9465	20.4660	21.2530	22.1571	22.8954	(42b)
Hot water usage for other uses	32.2915	31.1172	29.9430	28.7688	27.5945	26.4203	26.4203	27.5945	28.7688	29.9430	31.1172	32.2915	(42c)

Average daily hot water use (litres/day) 118.0151 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.3253	125.7119	122.4573	117.3360	113.2393	108.8102	106.9810	110.2201	113.6544	118.3207	123.5260	127.9677	(44)
Energy conte	203.2359	179.0121	188.2123	160.6271	152.4419	133.7949	129.3842	136.4755	140.1472	160.5600	175.9854	200.3665	(45)
Energy content (annual)										Total = Sum(45)m =		1960.2433	
Distribution loss (46)m = 0.15 x (45)m	30.4854	26.8518	28.2318	24.0941	22.8663	20.0692	19.4076	20.4713	21.0221	24.0840	26.3978	30.0550	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
										Total per year (kWh/year) = Sum(64)m =		2207.2753	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	84.3606	74.6819	79.3652	69.6517	67.4716	60.7300	59.8049	62.1628	62.8422	70.1708	74.7583	83.4065	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.5665	16.4906	13.4111	10.1530	7.5895	6.4074	6.9234	8.9993	12.0789	15.3369	17.9004	19.0825	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	224.2868	226.6142	220.7492	208.2634	192.5023	177.6891	167.7930	165.4656	171.3306	183.8164	199.5774	214.3906	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	(71)
Water heating gains (Table 5)													
	113.3879	111.1337	106.6737	96.7385	90.6876	84.3472	80.3829	83.5521	87.2808	94.3157	103.8310	112.1055	(72)
Total internal gains													
	437.8050	435.8023	422.3978	396.7187	372.3432	350.0075	336.6631	339.5808	352.2540	375.0327	402.8727	427.1425	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	6.0500	33.4622	0.6300	0.8270	0.7700	73.0953	(79)

Solar gains	73.0953	132.8884	190.0221	247.6641	274.5958	264.9514	258.6131	230.4683	203.9112	145.9899	89.9762	63.9718	(83)
Total gains	510.9003	568.6907	612.4199	644.3828	646.9390	614.9590	595.2762	570.0491	556.1652	521.0226	492.8488	491.1143	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	129.8847	129.8847	131.2898	135.6936	136.4565	139.5957	141.2200	141.2200	138.0082	134.1933	132.7257	133.4554	
alpha	9.6590	9.6590	9.7527	10.0462	10.0971	10.3064	10.4147	10.4147	10.2005	9.9462	9.8484	9.8970	
util living area													
	0.7262	0.6429	0.5469	0.4283	0.3336	0.2598	0.2074	0.2202	0.3054	0.4619	0.6269	0.7426	(86)
MIT	20.9842	20.9943	20.9987	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9998	20.9964	20.9827	(87)
Th 2	20.5853	20.5853	20.5896	20.6024	20.6045	20.6131	20.6174	20.6174	20.6088	20.5981	20.5938	20.5960	(88)
util rest of house													
	0.7102	0.6276	0.5324	0.4153	0.3207	0.2469	0.1944	0.2066	0.2908	0.4455	0.6097	0.7272	(89)
MIT 2	20.5688	20.5795	20.5883	20.6023	20.6045	20.6131	20.6174	20.6174	20.6088	20.5980	20.5903	20.5778	(90)
Living area fraction										fLA = Living area / (4) =		0.5576	(91)
MIT	20.8004	20.8108	20.8171	20.8240	20.8250	20.8288	20.8307	20.8307	20.8269	20.8220	20.8168	20.8036	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.8004	20.8108	20.8171	20.8240	20.8250	20.8288	20.8307	20.8307	20.8269	20.8220	20.8168	20.8036	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7185	0.6360	0.5404	0.4225	0.3279	0.2541	0.2017	0.2142	0.2990	0.4547	0.6191	0.7352	(94)
Useful gains	367.1006	361.6592	330.9707	272.2579	212.1218	156.2330	120.0602	122.0846	166.2762	236.8899	305.1447	361.0442	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	371.9854	363.4094	331.3518	272.2854	212.1236	156.2331	120.0602	122.0846	166.2767	236.9409	306.2195	366.3847	(97)
Space heating kWh													
	3.6342	1.1761	0.2835	0.0197	0.0014	0.0000	0.0000	0.0000	0.0000	0.0379	0.7738	3.9733	(98a)
Space heating requirement - total per year (kWh/year)												9.9001	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	3.6342	1.1761	0.2835	0.0197	0.0014	0.0000	0.0000	0.0000	0.0000	0.0379	0.7738	3.9733	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9.9001	
Space heating per m2										(98c) / (4) =		0.1935	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	3.6342	1.1761	0.2835	0.0197	0.0014	0.0000	0.0000	0.0000	0.0000	0.0379	0.7738	3.9733	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	3.6342	1.1761	0.2835	0.0197	0.0014	0.0000	0.0000	0.0000	0.0000	0.0379	0.7738	3.9733	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9074	8.0454	8.9074	8.6201	8.9074	8.6201	8.9074	8.9074	8.6201	8.9074	8.6201	8.9074	(231)

Lighting	16.2512	13.0373	11.7386	8.6002	6.6431	5.4274	6.0600	7.8770	10.2315	13.4243	15.1627	16.7028	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.9890	-18.6157	-31.6465	-41.8691	-49.0676	-46.3455	-46.0104	-40.5058	-32.7427	-22.8928	-13.0639	-9.4446	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.0488	-5.2230	-12.2849	-22.0132	-30.4827	-30.1706	-30.2222	-23.4005	-15.7615	-7.8062	-2.9515	-1.6281	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	9.9001	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2207.2753	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	104.8780	(230a)
Total electricity for the above, kWh/year	104.8780	(231)
Electricity for lighting (calculated in Appendix L)	131.1561	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-547.1869	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1906.0227	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	9.9001	25.1600	2.4909	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	25.1600	555.3505	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	104.8780	25.1600	26.3873	(249)
Energy for lighting	131.1561	25.1600	32.9989	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1936	25.1600	-91.3795	
PV Unit electricity exported	-183.9933	5.8100	-10.6900	
Total			-102.0695	(252)
Total energy cost			515.1580	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	9.9001	0.1613	1.5966	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2207.2753	0.1413	311.7942	(264)
Space and water heating			313.3909	(265)
Pumps, fans and electric keep-hot	104.8780	0.1387	14.5479	(267)
Energy for lighting	131.1561	0.1443	18.9299	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1936	0.1319	-47.9013	
PV Unit electricity exported	-183.9933	0.1230	-22.6294	
Total			-70.5307	(269)
Total CO2, kg/year			276.3379	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	9.9001	1.5968	15.8083	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	1.5223	3360.2168	(278)
Space and water heating			3376.0251	(279)
Pumps, fans and electric keep-hot	104.8780	1.5128	158.6595	(281)
Energy for lighting	131.1561	1.5338	201.1716	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1936	1.4873	-540.1750	
PV Unit electricity exported	-183.9933	0.4514	-83.0493	
Total			-623.2243	(283)
Total Primary energy kWh/year			3112.6319	(286)

SAP 10 EPC IMPROVEMENTS

Unit 413 L02_Copy

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 80
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£617	£617	£0
Space heating	£29	£29	£0
Water heating	£555	£555	£0
Lighting	£33	£33	£0
Generated (PV)	-£102	-£102	£0
Total cost of fuels	£515	£515	£0
Total cost of uses	£515	£515	£0
Delivered energy	37 kWh/m²	37 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	61 kWh/m²	61 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.1700 (1b)	x	2.4000 (2b)	=	122.8080	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.1700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	122.8080	(5)

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2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor (20) = 1 - [0.075 x (19)] =		0.7750 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) =		0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.0500	1.2357	7.4762			(27)
External Wall 1	16.0600	6.0500	10.0100	0.1400	1.4014	14.0000	140.1400	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		8.8776			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			16.0600	0.0000	0.0000	20.0000	321.2000	(32)
Party Floor 1			51.1700			80.0000	4093.6000	(32d)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			79.3800			9.0000	714.4200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10291.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		201.1288 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.6000	0.0500	0.1300
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.3345 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	10.2121 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.6805	11.5628	11.4450	10.8561	10.7383	10.1494	10.1494	10.0316	10.3850	10.7383	10.9739	11.2094	(38)
Heat transfer coeff	21.8927	21.7749	21.6571	21.0682	20.9504	20.3615	20.3615	20.2437	20.5971	20.9504	21.1860	21.4216	(39)
Average = Sum(39)m / 12 =												21.0388	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4278	0.4255	0.4232	0.4117	0.4094	0.3979	0.3979	0.3956	0.4025	0.4094	0.4140	0.4186	(40)
HLP (average)												0.4112	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.7246 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.0608	71.9628	70.3629	67.3017	65.0426	62.5233	61.0913	62.6791	64.4197	67.1247	70.2516	72.7809	(42a)

Hot water usage for baths

22.9731	22.6319	22.1514	21.2656	20.6022	19.8667	19.4694	19.9465	20.4660	21.2530	22.1571	22.8954	(42b)

Hot water usage for other uses

32.2915	31.1172	29.9430	28.7688	27.5945	26.4203	26.4203	27.5945	28.7688	29.9430	31.1172	32.2915	(42c)

Average daily hot water use (litres/day)		118.0151 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.3253	125.7119	122.4573	117.3360	113.2393	108.8102	106.9810	110.2201	113.6544	118.3207	123.5260	127.9677	(44)
Energy conte	203.2359	179.0121	188.2123	160.6271	152.4419	133.7949	129.3842	136.4755	140.1472	160.5600	175.9854	200.3665	(45)
Energy content (annual)										Total = Sum(45)m =		1960.2433	

Distribution loss (46)m = 0.15 x (45)m

30.4854	26.8518	28.2318	24.0941	22.8663	20.0692	19.4076	20.4713	21.0221	24.0840	26.3978	30.0550	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
									Total per year (kWh/year) = Sum(64)m =		2207.2753	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

84.3606	74.6819	79.3652	69.6517	67.4716	60.7300	59.8049	62.1628	62.8422	70.1708	74.7583	83.4065	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.5665	16.4906	13.4111	10.1530	7.5895	6.4074	6.9234	8.9993	12.0789	15.3369	17.9004	19.0825	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	224.2868	226.6142	220.7492	208.2634	192.5023	177.6891	167.7930	165.4656	171.3306	183.8164	199.5774	214.3906	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	(71)
Water heating gains (Table 5)	113.3879	111.1337	106.6737	96.7385	90.6876	84.3472	80.3829	83.5521	87.2808	94.3157	103.8310	112.1055	(72)
Total internal gains	437.8050	435.8023	422.3978	396.7187	372.3432	350.0075	336.6631	339.5808	352.2540	375.0327	402.8727	427.1425	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	6.0500	36.7938	0.6300	0.8270	0.7700	80.3729	(79)

Solar gains	80.3729	136.9048	187.3191	232.0975	259.9685	258.0886	248.8249	228.0319	202.8270	151.3090	96.2682	68.7825	(83)
Total gains	518.1779	572.7071	609.7169	628.8162	632.3117	608.0961	585.4880	567.6127	555.0810	526.3417	499.1409	495.9250	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	130.5835	131.2898	132.0039	135.6936	136.4565	140.4031	140.4031	141.2200	138.7974	136.4565	134.9393	133.4554	
alpha	9.7056	9.7527	9.8003	10.0462	10.0971	10.3602	10.3602	10.4147	10.2532	10.0971	9.9960	9.8970	
util living area	0.6984	0.6101	0.5147	0.4054	0.3081	0.2143	0.1530	0.1641	0.2560	0.4139	0.5887	0.7171	(86)
MIT	20.9890	20.9967	20.9993	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9999	20.9982	20.9875	(87)
Th 2	20.5874	20.5896	20.5917	20.6024	20.6045	20.6153	20.6153	20.6174	20.6110	20.6045	20.6003	20.5960	(88)
util rest of house	0.6823	0.5950	0.5003	0.3921	0.2950	0.2014	0.1396	0.1504	0.2416	0.3982	0.5721	0.7013	(89)
MIT 2	20.5761	20.5862	20.5910	20.6024	20.6045	20.6153	20.6153	20.6174	20.6110	20.6045	20.5985	20.5829	(90)
Living area fraction									fLA = Living area / (4) =			0.5576	(91)
MIT	20.8063	20.8150	20.8187	20.8240	20.8250	20.8298	20.8298	20.8307	20.8279	20.8250	20.8213	20.8085	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.8063	20.8150	20.8187	20.8240	20.8250	20.8298	20.8298	20.8307	20.8279	20.8250	20.8213	20.8085	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6909	0.6033	0.5083	0.3995	0.3023	0.2086	0.1471	0.1580	0.2496	0.4070	0.5813	0.7096	(94)
Useful gains	357.9877	345.5238	309.8992	251.2030	191.1725	126.8478	86.1248	89.6946	138.5746	214.2033	290.1524	351.9190	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	361.3675	346.5482	310.1013	251.2180	191.1733	126.8478	86.1248	89.6946	138.5747	214.2178	290.7000	355.7795	(97)
Space heating kWh	2.5146	0.6884	0.1504	0.0108	0.0006	0.0000	0.0000	0.0000	0.0000	0.0108	0.3943	2.8722	(98a)
Space heating requirement - total per year (kWh/year)												6.6421	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	2.5146	0.6884	0.1504	0.0108	0.0006	0.0000	0.0000	0.0000	0.0000	0.0108	0.3943	2.8722	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6.6421	
Space heating per m2											(98c) / (4) =	0.1298	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	2.5146	0.6884	0.1504	0.0108	0.0006	0.0000	0.0000	0.0000	0.0000	0.0108	0.3943	2.8722	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	2.5146	0.6884	0.1504	0.0108	0.0006	0.0000	0.0000	0.0000	0.0000	0.0108	0.3943	2.8722	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9074	8.0454	8.9074	8.6201	8.9074	8.6201	8.9074	8.9074	8.6201	8.9074	8.6201	8.9074	(231)
Lighting	16.2512	13.0373	11.7386	8.6002	6.6431	5.4274	6.0600	7.8770	10.2315	13.4243	15.1627	16.7028	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.1380	-19.3589	-31.6538	-40.1502	-47.3719	-45.6699	-44.9508	-40.4933	-32.9629	-23.9064	-14.0617	-10.2247	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4089	-5.5789	-12.2926	-20.4189	-28.5624	-29.3529	-28.9317	-23.3873	-15.9501	-8.4020	-3.3306	-1.8520	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												6.6421	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2207.2753	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	104.8780	(230a)
Total electricity for the above, kWh/year	104.8780	(231)
Electricity for lighting (calculated in Appendix L)	131.1561	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-543.4106	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1906.5410	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	6.6421	16.4900	1.0953	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	16.4900	363.9797	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	104.8780	16.4900	17.2944	(249)
Energy for lighting	131.1561	16.4900	21.6276	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-362.9424	16.4900	-59.8492	
PV Unit electricity exported	-180.4682	5.5900	-10.0882	
Total			-69.9374	(252)
Total energy cost			334.0596	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2505	(257)
SAP value		79.7292	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6.6421	0.1617	1.0738	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2207.2753	0.1413	311.7942	(264)
Space and water heating			312.8681	(265)
Pumps, fans and electric keep-hot	104.8780	0.1387	14.5479	(267)
Energy for lighting	131.1561	0.1443	18.9299	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-362.9424	0.1322	-47.9814	
PV Unit electricity exported	-180.4682	0.1235	-22.2818	
Total			-70.2632	(269)
Total CO2, kg/year			276.0827	(272)
CO2 emissions per m2			5.4000	(273)
EI value			96.1532	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		51.1700	(1b)	x 2.4000	(2b) =	122.8080	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.1700						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		122.8080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.0500	1.2357	7.4762			(27)
External Wall 1	16.0600	6.0500	10.0100	0.1400	1.4014	14.0000	140.1400	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	8.8776			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			16.0600	0.0000	0.0000	20.0000	321.2000	(32)
Party Floor 1			51.1700			80.0000	4093.6000	(32d)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			79.3800			9.0000	714.4200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10291.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		201.1288 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	2.6000	0.0500	0.1300
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.3345 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	10.2121 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.7983	11.7983	11.5628	10.8561	10.7383	10.2672	10.0316	10.0316	10.5027	11.0916	11.3272	11.2094	(38)
Heat transfer coeff	22.0105	22.0105	21.7749	21.0682	20.9504	20.4793	20.2437	20.2437	20.7149	21.3038	21.5393	21.4216	(39)
Average = Sum(39)m / 12 =												21.1467	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4301	0.4301	0.4255	0.4117	0.4094	0.4002	0.3956	0.3956	0.4048	0.4163	0.4209	0.4186	(40)
HLP (average)												0.4133	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.7246 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.0608	71.9628	70.3629	67.3017	65.0426	62.5233	61.0913	62.6791	64.4197	67.1247	70.2516	72.7809	(42a)

Hot water usage for baths

22.9731	22.6319	22.1514	21.2656	20.6022	19.8667	19.4694	19.9465	20.4660	21.2530	22.1571	22.8954	(42b)

Hot water usage for other uses

32.2915	31.1172	29.9430	28.7688	27.5945	26.4203	26.4203	27.5945	28.7688	29.9430	31.1172	32.2915	(42c)

Average daily hot water use (litres/day)		118.0151 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.3253	125.7119	122.4573	117.3360	113.2393	108.8102	106.9810	110.2201	113.6544	118.3207	123.5260	127.9677	(44)
Energy conte	203.2359	179.0121	188.2123	160.6271	152.4419	133.7949	129.3842	136.4755	140.1472	160.5600	175.9854	200.3665	(45)
Energy content (annual)										Total = Sum(45)m =		1960.2433	

Distribution loss (46)m = 0.15 x (45)m

30.4854	26.8518	28.2318	24.0941	22.8663	20.0692	19.4076	20.4713	21.0221	24.0840	26.3978	30.0550	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
									Total per year (kWh/year) = Sum(64)m =			2207.2753	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	84.3606	74.6819	79.3652	69.6517	67.4716	60.7300	59.8049	62.1628	62.8422	70.1708	74.7583	83.4065	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.5665	16.4906	13.4111	10.1530	7.5895	6.4074	6.9234	8.9993	12.0789	15.3369	17.9004	19.0825	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	224.2868	226.6142	220.7492	208.2634	192.5023	177.6891	167.7930	165.4656	171.3306	183.8164	199.5774	214.3906	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	(71)
Water heating gains (Table 5)	113.3879	111.1337	106.6737	96.7385	90.6876	84.3472	80.3829	83.5521	87.2808	94.3157	103.8310	112.1055	(72)
Total internal gains	437.8050	435.8023	422.3978	396.7187	372.3432	350.0075	336.6631	339.5808	352.2540	375.0327	402.8727	427.1425	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	6.0500	33.4622	0.6300	0.8270	0.7700	73.0953	(79)

Solar gains	73.0953	132.8884	190.0221	247.6641	274.5958	264.9514	258.6131	230.4683	203.9112	145.9899	89.9762	63.9718	(83)
Total gains	510.9003	568.6907	612.4199	644.3828	646.9390	614.9590	595.2762	570.0491	556.1652	521.0226	492.8488	491.1143	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	129.8847	129.8847	131.2898	135.6936	136.4565	139.5957	141.2200	141.2200	138.0082	134.1933	132.7257	133.4554	
alpha	9.6590	9.6590	9.7527	10.0462	10.0971	10.3064	10.4147	10.4147	10.2005	9.9462	9.8484	9.8970	
util living area	0.7262	0.6429	0.5469	0.4283	0.3336	0.2598	0.2074	0.2202	0.3054	0.4619	0.6269	0.7426	(86)
MIT	20.9842	20.9943	20.9987	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9998	20.9964	20.9827	(87)
Th 2	20.5853	20.5853	20.5896	20.6024	20.6045	20.6131	20.6174	20.6174	20.6088	20.5981	20.5938	20.5960	(88)
util rest of house	0.7102	0.6276	0.5324	0.4153	0.3207	0.2469	0.1944	0.2066	0.2908	0.4455	0.6097	0.7272	(89)
MIT 2	20.5688	20.5795	20.5883	20.6023	20.6045	20.6131	20.6174	20.6174	20.6088	20.5980	20.5903	20.5778	(90)
Living area fraction										fLA = Living area / (4) =		0.5576	(91)
MIT	20.8004	20.8108	20.8171	20.8240	20.8250	20.8288	20.8307	20.8307	20.8269	20.8220	20.8168	20.8036	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.8004	20.8108	20.8171	20.8240	20.8250	20.8288	20.8307	20.8307	20.8269	20.8220	20.8168	20.8036	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7185	0.6360	0.5404	0.4225	0.3279	0.2541	0.2017	0.2142	0.2990	0.4547	0.6191	0.7352	(94)
Useful gains	367.1006	361.6592	330.9707	272.2579	212.1218	156.2330	120.0602	122.0846	166.2762	236.8899	305.1447	361.0442	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	371.9854	363.4094	331.3518	272.2854	212.1236	156.2331	120.0602	122.0846	166.2767	236.9409	306.2195	366.3847	(97)
Space heating kWh	3.6342	1.1761	0.2835	0.0197	0.0014	0.0000	0.0000	0.0000	0.0000	0.0379	0.7738	3.9733	(98a)
Space heating requirement - total per year (kWh/year)												9.9001	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	3.6342	1.1761	0.2835	0.0197	0.0014	0.0000	0.0000	0.0000	0.0000	0.0379	0.7738	3.9733	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9.9001	
Space heating per m2											(98c) / (4) =	0.1935	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	3.6342	1.1761	0.2835	0.0197	0.0014	0.0000	0.0000	0.0000	0.0000	0.0379	0.7738	3.9733	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													

	3.6342	1.1761	0.2835	0.0197	0.0014	0.0000	0.0000	0.0000	0.0000	0.0379	0.7738	3.9733 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	8.9074	8.0454	8.9074	8.6201	8.9074	8.6201	8.9074	8.9074	8.6201	8.9074	8.6201	8.9074 (231)
Lighting	16.2512	13.0373	11.7386	8.6002	6.6431	5.4274	6.0600	7.8770	10.2315	13.4243	15.1627	16.7028 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-10.9890	-18.6157	-31.6465	-41.8691	-49.0676	-46.3455	-46.0104	-40.5058	-32.7427	-22.8928	-13.0639	-9.4446 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.0488	-5.2230	-12.2849	-22.0132	-30.4827	-30.1706	-30.2222	-23.4005	-15.7615	-7.8062	-2.9515	-1.6281 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	9.9001 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2207.2753 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	104.8780 (230a)
Total electricity for the above, kWh/year	104.8780 (231)
Electricity for lighting (calculated in Appendix L)	131.1561 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-547.1869 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1906.0227 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	9.9001	25.1600	2.4909	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	25.1600	555.3505	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	104.8780	25.1600	26.3873	(249)
Energy for lighting	131.1561	25.1600	32.9989	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1936	25.1600	-91.3795	
PV Unit electricity exported	-183.9933	5.8100	-10.6900	
Total			-102.0695	(252)
Total energy cost			515.1580	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	9.9001	0.1613	1.5966	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2207.2753	0.1413	311.7942	(264)
Space and water heating			313.3909	(265)
Pumps, fans and electric keep-hot	104.8780	0.1387	14.5479	(267)
Energy for lighting	131.1561	0.1443	18.9299	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1936	0.1319	-47.9013	
PV Unit electricity exported	-183.9933	0.1230	-22.6294	
Total			-70.5307	(269)
Total CO2, kg/year			276.3379	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	9.9001	1.5968	15.8083	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	1.5223	3360.2168	(278)
Space and water heating			3376.0251	(279)

Pumps, fans and electric keep-hot	104.8780	1.5128	158.6595	(281)
Energy for lighting	131.1561	1.5338	201.1716	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1936	1.4873	-540.1750	
PV Unit electricity exported	-183.9933	0.4514	-83.0493	
Total			-623.2243	(283)
Total Primary energy kWh/year			3112.6319	(286)

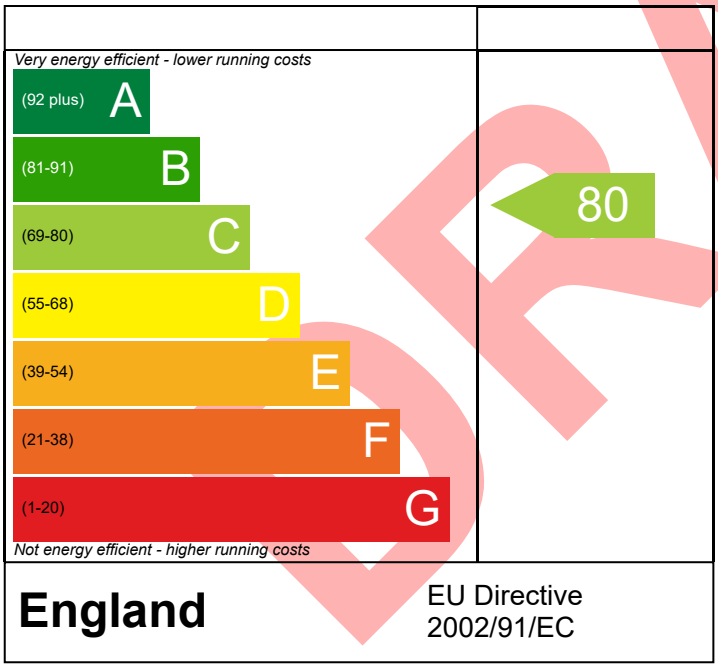
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	51.17 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

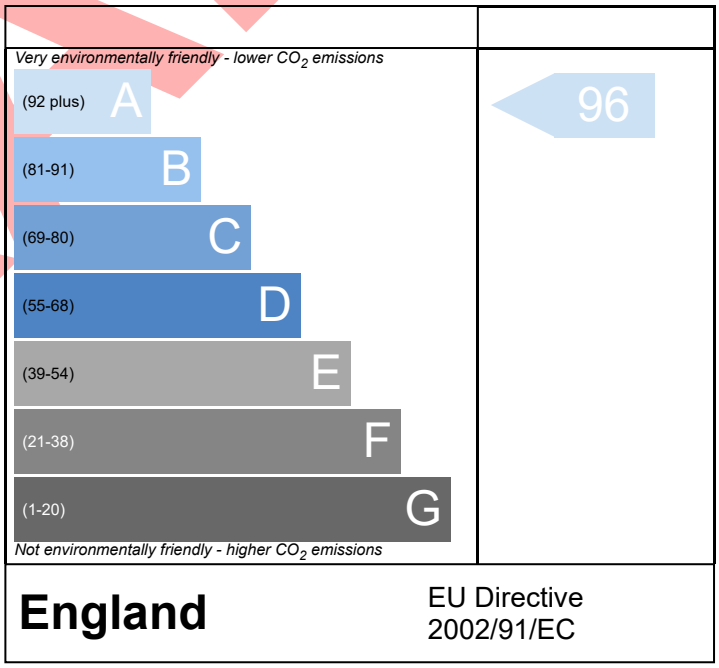
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:29

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	64 m^2
Site Reference	Unit 414 L02_Copy	Plot Reference	Unit 414 L02_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.61 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	5.6 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*62.72 kWh$_{PE}$/m^2*	
Dwelling primary energy	62.24 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*22.8 kWh/m^2*	
Dwelling fabric energy efficiency	23.4 kWh/m^2	FAIL

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	24.52	0.14 **(!)**
Party wall: Party Wall (1)	14.85	0 **(!)**
Party wall: Party Wall (2)	29.36	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	7.88	South West	0.83	1.3
NW, Opening Type 1	11.81	North West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.83 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 414 L02_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 414 L02_Copy	**Prop Type Ref**	Unit 414 L02
Property			

SAP Rating	78 C	**DER**	5.60	**TER**	11.61
Environmental	96 A	**% DER < TER**			51.77
CO_2 Emissions (t/year)	0.36	**DFEE**	23.37	**TFEE**	22.77
Compliance Check	See BREL	**% DFEE < TFEE**			-2.62
% DPER < TPER	0.76	**DPER**	62.24	**TPER**	62.72

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.3100 (1b)	x	2.4000 (2b)	=	154.3440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.3100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	154.3440	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.2100	19.6900	24.5200	0.1400	3.4328	14.0000	343.2800	(29a)
Total net area of external elements Aum(A, m2)			44.2100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.7645			(33)
Party Wall 1			14.8500	0.0000	0.0000	20.0000	297.0000	(32)
Wall to corridor			29.3600	0.0000	0.0000	20.0000	587.2000	(32)
Party Floor 1			64.3100			80.0000	5144.8000	(32d)
Party Ceiling 1			64.3100			80.0000	5144.8000	(32b)
Internal Wall 1			98.7600			9.0000	888.8400	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12405.9200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		192.9081 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240

E4 Jamb	23.2000	0.0500	1.1600	
E7 Party floor between dwellings (in blocks of flats)	16.3700	0.0700	1.1459	
E18 Party wall between dwellings	2.7000	0.0600	0.1620	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	14.9200	0.0000	0.0000	
E16 Corner (normal)	2.7000	0.0900	0.2430	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.1349 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 30.8994 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.4106	15.2482	15.0859	14.2741	14.1118	13.3000	13.3000	13.1377	13.6247	14.1118	14.4365	14.7612	(38)
Heat transfer coeff	46.3100	46.1477	45.9853	45.1736	45.0112	44.1995	44.1995	44.0371	44.5242	45.0112	45.3359	45.6606	(39)
Average = Sum(39)m / 12 =												45.1330	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7201	0.7176	0.7151	0.7024	0.6999	0.6873	0.6873	0.6848	0.6923	0.6999	0.7050	0.7100	(40)
HLP (average)												0.7018	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1005 (42)
Hot water usage for mixer showers

81.7276	80.4994	78.7097	75.2853	72.7583	69.9401	68.3382	70.1144	72.0615	75.0873	78.5852	81.4145	(42a)

Hot water usage for baths

25.6836	25.3022	24.7650	23.7747	23.0331	22.2107	21.7666	22.3000	22.8807	23.7606	24.7714	25.5968	(42b)

Hot water usage for other uses

36.1413	34.8271	33.5129	32.1986	30.8844	29.5702	29.5702	30.8844	32.1986	33.5129	34.8271	36.1413	(42c)

Average daily hot water use (litres/day) 132.0187 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.5526	140.6287	136.9876	131.2586	126.6757	121.7210	119.6750	123.2988	127.1408	132.3608	138.1837	143.1526	(44)
Energy conte	227.3522	200.2534	210.5448	179.6865	170.5299	149.6702	144.7365	152.6697	156.7773	179.6124	196.8681	224.1424	(45)
Energy content (annual)											Total = Sum(45)m =	2192.8435	
Distribution loss (46)m = 0.15 x (45)m	34.1028	30.0380	31.5817	26.9530	25.5795	22.4505	21.7105	22.9004	23.5166	26.9419	29.5302	33.6214	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(64)
									Total per year (kWh/year) = Sum(64)m =		2439.8755	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

92.3793	81.7446	86.7908	75.9890	73.4858	66.0085	64.9095	67.5473	68.3717	76.5058	81.7018	91.3120	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.1424	18.7785	15.2717	11.5617	8.6425	7.2964	7.8840	10.2479	13.7547	17.4647	20.3839	21.7301	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	274.1367	276.9814	269.8129	254.5520	235.2878	217.1823	205.0866	202.2419	209.4104	224.6713	243.9355	262.0411	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(70)
Losses e.g. evaporation (negative values) (Table 5)	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	(71)
Water heating gains (Table 5)	124.1657	121.6437	116.6543	105.5402	98.7713	91.6785	87.2440	90.7894	94.9607	102.8303	113.4748	122.7312	(72)
Total internal gains	511.1586	509.1174	493.4527	463.3677	434.4154	407.8709	391.9284	394.9930	409.8396	436.6802	469.5080	498.2161	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(79)
Northwest	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(81)

Solar gains	152.7958	276.2486	420.4233	592.0739	728.1137	751.4140	712.5556	606.6966	479.1778	316.7586	185.9245	128.8782	(83)
Total gains	663.9545	785.3661	913.8760	1055.4416	1162.5291	1159.2849	1104.4840	1001.6896	889.0173	753.4388	655.4324	627.0944	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	74.4135	74.6752	74.9389	76.2855	76.5607	77.9668	77.9668	78.2542	77.3982	76.5607	76.0123	75.4718	
alpha	5.9609	5.9783	5.9959	6.0857	6.1040	6.1978	6.1978	6.2169	6.1599	6.1040	6.0675	6.0315	
util living area	0.9129	0.8319	0.6961	0.5133	0.3596	0.2440	0.1761	0.2022	0.3452	0.6080	0.8411	0.9285	(86)
MIT	20.6238	20.7983	20.9311	20.9890	20.9988	20.9999	21.0000	21.0000	20.9993	20.9773	20.8219	20.5833	(87)
Th 2	20.3231	20.3253	20.3276	20.3387	20.3409	20.3521	20.3521	20.3543	20.3476	20.3409	20.3365	20.3320	(88)
util rest of house	0.8993	0.8114	0.6697	0.4863	0.3343	0.2193	0.1502	0.1738	0.3127	0.5728	0.8180	0.9169	(89)
MIT 2	19.9049	20.1099	20.2586	20.3287	20.3400	20.3520	20.3521	20.3543	20.3472	20.3210	20.1512	19.8644	(90)
Living area fraction										fLA = Living area / (4) =		0.3816	(91)
MIT	20.1792	20.3726	20.5152	20.5807	20.5914	20.5993	20.5993	20.6007	20.5960	20.5714	20.4071	20.1387	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1792	20.3726	20.5152	20.5807	20.5914	20.5993	20.5993	20.6007	20.5960	20.5714	20.4071	20.1387	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8962	0.8129	0.6772	0.4962	0.3439	0.2287	0.1600	0.1847	0.3251	0.5852	0.8206	0.9132	(94)
Useful gains	595.0388	638.4221	618.8617	523.7474	399.8206	265.1421	176.7657	184.9820	289.0372	440.9435	537.8315	572.6406	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	735.3680	714.0235	644.4936	527.6585	400.2118	265.1640	176.7674	184.9862	289.2306	448.8256	603.2915	727.7727	(97)
Space heating kWh	104.4049	50.8041	19.0701	2.8159	0.2910	0.0000	0.0000	0.0000	0.0000	5.8643	47.1312	115.4183	(98a)
Space heating requirement - total per year (kWh/year)												345.7999	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	104.4049	50.8041	19.0701	2.8159	0.2910	0.0000	0.0000	0.0000	0.0000	5.8643	47.1312	115.4183	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												345.7999	
Space heating per m2											(98c) / (4) =	5.3771	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	104.4049	50.8041	19.0701	2.8159	0.2910	0.0000	0.0000	0.0000	0.0000	5.8643	47.1312	115.4183	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	104.4049	50.8041	19.0701	2.8159	0.2910	0.0000	0.0000	0.0000	0.0000	5.8643	47.1312	115.4183	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.1948	10.1114	11.1948	10.8337	11.1948	10.8337	11.1948	11.1948	10.8337	11.1948	10.8337	11.1948	(231)
Lighting	18.5059	14.8461	13.3673	9.7934	7.5647	6.1804	6.9008	8.9699	11.6510	15.2868	17.2664	19.0202	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.4007	-24.4116	-39.4994	-49.6586	-58.3512	-56.1753	-55.2817	-49.8783	-40.7154	-29.7229	-17.7115	-12.9855	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.8931	-6.9495	-15.7665	-26.5116	-37.1419	-38.1716	-37.6311	-30.4564	-20.7964	-10.9074	-4.1606	-2.2017	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	345.7999	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2439.8755	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	131.8098	(230a)
Total electricity for the above, kWh/year	131.8098	(231)
Electricity for lighting (calculated in Appendix L)	149.3528	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-683.3800	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)

Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2383.4580	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	345.7999	16.4900	57.0224	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2439.8755	16.4900	402.3355	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	131.8098	16.4900	21.7354	(249)
Energy for lighting	149.3528	16.4900	24.6283	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-449.7921	16.4900	-74.1707	
PV Unit electricity exported	-233.5879	5.5900	-13.0576	
Total			-87.2283	(252)
Total energy cost			418.4933	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.3783	(257)
SAP value		77.6584	
SAP rating (Section 12)		78	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	345.7999	0.1597	55.2330	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2439.8755	0.1413	344.7254	(264)
Space and water heating			399.9584	(265)
Pumps, fans and electric keep-hot	131.8098	0.1387	18.2836	(267)
Energy for lighting	149.3528	0.1443	21.5562	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-449.7921	0.1323	-59.5275	
PV Unit electricity exported	-233.5879	0.1231	-28.7646	
Total			-88.2920	(269)
Total CO2, kg/year			351.5063	(272)
CO2 emissions per m2			5.4700	(273)
EI value			95.6910	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		64.3100 (1b)	x	2.4000 (2b)	=	154.3440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.3100						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		154.3440	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.2100	19.6900	24.5200	0.1400	3.4328	14.0000	343.2800	(29a)
Total net area of external elements Aum(A, m2)			44.2100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.7645			(33)
Party Wall 1			14.8500	0.0000	0.0000	20.0000	297.0000	(32)
Wall to corridor			29.3600	0.0000	0.0000	20.0000	587.2000	(32)
Party Floor 1			64.3100			80.0000	5144.8000	(32d)
Party Ceiling 1			64.3100			80.0000	5144.8000	(32b)
Internal Wall 1			98.7600			9.0000	888.8400	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12405.9200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 192.9081 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.3700	0.0700	1.1459
E18 Party wall between dwellings	2.7000	0.0600	0.1620
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	14.9200	0.0000	0.0000
E16 Corner (normal)	2.7000	0.0900	0.2430

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.1349 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 30.8994 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.5729	15.5729	15.2482	14.2741	14.1118	13.4624	13.1377	13.1377	13.7871	14.5988	14.9235	14.7612	(38)
Heat transfer coeff	46.4724	46.4724	46.1477	45.1736	45.0112	44.3618	44.0371	44.0371	44.6865	45.4983	45.8230	45.6606	(39)

Average = Sum(39)m / 12 = 45.2818

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7226	0.7226	0.7176	0.7024	0.6999	0.6898	0.6848	0.6848	0.6949	0.7075	0.7125	0.7100	(40)
HLP (average)												0.7041	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1005 (42)
Hot water usage for mixer showers

81.7276	80.4994	78.7097	75.2853	72.7583	69.9401	68.3382	70.1144	72.0615	75.0873	78.5852	81.4145	(42a)

Hot water usage for baths

25.6836	25.3022	24.7650	23.7747	23.0331	22.2107	21.7666	22.3000	22.8807	23.7606	24.7714	25.5968	(42b)

Hot water usage for other uses

36.1413	34.8271	33.5129	32.1986	30.8844	29.5702	29.5702	30.8844	32.1986	33.5129	34.8271	36.1413	(42c)

Average daily hot water use (litres/day) 132.0187 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.5526	140.6287	136.9876	131.2586	126.6757	121.7210	119.6750	123.2988	127.1408	132.3608	138.1837	143.1526	(44)
Energy conte	227.3522	200.2534	210.5448	179.6865	170.5299	149.6702	144.7365	152.6697	156.7773	179.6124	196.8681	224.1424	(45)
Energy content (annual)											Total = Sum(45)m =	2192.8435	
Distribution loss (46)m = 0.15 x (45)m	34.1028	30.0380	31.5817	26.9530	25.5795	22.4505	21.7105	22.9004	23.5166	26.9419	29.5302	33.6214	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(64)

Total per year (kWh/year) = Sum(64)m = 2439.8755 (64)
Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month

92.3793	81.7446	86.7908	75.9890	73.4858	66.0085	64.9095	67.5473	68.3717	76.5058	81.7018	91.3120	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	21.1424	18.7785	15.2717	11.5617	8.6425	7.2964	7.8840	10.2479	13.7547	17.4647	20.3839	21.7301	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	274.1367	276.9814	269.8129	254.5520	235.2878	217.1823	205.0866	202.2419	209.4104	224.6713	243.9355	262.0411	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	(71)

Water heating gains (Table 5)

	124.1657	121.6437	116.6543	105.5402	98.7713	91.6785	87.2440	90.7894	94.9607	102.8303	113.4748	122.7312	(72)

Total internal gains

	511.1586	509.1174	493.4527	463.3677	434.4154	407.8709	391.9284	394.9930	409.8396	436.6802	469.5080	498.2161	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(79)
Northwest	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(81)

Solar gains	137.9782	265.6866	421.5549	624.1600	760.9473	764.1300	733.2127	606.0620	475.9114	302.5081	172.4386	119.0880	(83)
Total gains	649.1368	774.8041	915.0076	1087.5277	1195.3628	1172.0009	1125.1411	1001.0551	885.7510	739.1883	641.9466	617.3041	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	74.1535	74.1535	74.6752	76.2855	76.5607	77.6814	78.2542	78.2542	77.1170	75.7411	75.2044	75.4718	
alpha	5.9436	5.9436	5.9783	6.0857	6.1040	6.1788	6.2169	6.2169	6.1411	6.0494	6.0136	6.0315	
util living area													
	0.9271	0.8567	0.7305	0.5380	0.3871	0.2951	0.2387	0.2727	0.4126	0.6700	0.8689	0.9400	(86)
MIT	20.5665	20.7475	20.9049	20.9848	20.9980	20.9997	20.9999	20.9999	20.9978	20.9574	20.7701	20.5273	(87)
Th 2	20.3209	20.3209	20.3253	20.3387	20.3409	20.3498	20.3543	20.3543	20.3454	20.3342	20.3298	20.3320	(88)
util rest of house													
	0.9154	0.8384	0.7058	0.5121	0.3626	0.2706	0.2135	0.2443	0.3800	0.6362	0.8486	0.9301	(89)
MIT 2	19.8337	20.0470	20.2278	20.3244	20.3393	20.3496	20.3543	20.3542	20.3438	20.2950	20.0859	19.7960	(90)
Living area fraction										fLA = Living area / (4) =		0.3816	(91)
MIT	20.1133	20.3143	20.4862	20.5764	20.5906	20.5977	20.6007	20.6006	20.5934	20.5478	20.3470	20.0750	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1133	20.3143	20.4862	20.5764	20.5906	20.5977	20.6007	20.6006	20.5934	20.5478	20.3470	20.0750	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9114	0.8382	0.7118	0.5215	0.3719	0.2799	0.2231	0.2551	0.3924	0.6472	0.8492	0.9258	(94)
Useful gains	591.6487	649.4336	651.2843	567.1101	444.5162	328.0844	251.0229	255.4024	347.5726	478.4320	545.1349	571.5150	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	753.4718	744.2246	686.9624	572.6379	445.1895	328.1751	251.0403	255.4414	348.2578	493.5547	629.9265	747.6945	(97)
Space heating kWh													
	120.3964	63.6995	26.5445	3.9801	0.5010	0.0000	0.0000	0.0000	0.0000	11.2513	61.0500	131.0776	(98a)
Space heating requirement - total per year (kWh/year)												418.5003	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	120.3964	63.6995	26.5445	3.9801	0.5010	0.0000	0.0000	0.0000	0.0000	11.2513	61.0500	131.0776	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												418.5003	
Space heating per m2											(98c) / (4) =	6.5075	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	120.3964	63.6995	26.5445	3.9801	0.5010	0.0000	0.0000	0.0000	0.0000	11.2513	61.0500	131.0776	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	120.3964	63.6995	26.5445	3.9801	0.5010	0.0000	0.0000	0.0000	0.0000	11.2513	61.0500	131.0776	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													

	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.1948	10.1114	11.1948	10.8337	11.1948	10.8337	11.1948	11.1948	10.8337	11.1948	10.8337	11.1948	(231)
Lighting	18.5059	14.8461	13.3673	9.7934	7.5647	6.1804	6.9008	8.9699	11.6510	15.2868	17.2664	19.0202	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-13.9632	-23.5442	-39.5900	-51.7924	-60.4179	-56.9935	-56.5645	-49.8935	-40.4465	-28.5276	-16.4999	-12.0106	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4329	-6.4348	-15.6570	-28.5444	-39.6226	-39.2313	-39.3039	-30.4736	-20.5513	-10.0788	-3.6407	-1.9141	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	418.5003	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2439.8755	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	131.8098	(230a)
Total electricity for the above, kWh/year	131.8098	(231)
Electricity for lighting (calculated in Appendix L)	149.3528	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-688.1289	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2451.4094	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	418.5003	25.1600	105.2947	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2439.8755	25.1600	613.8727	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	131.8098	25.1600	33.1633	(249)
Energy for lighting	149.3528	25.1600	37.5772	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-450.2436	25.1600	-113.2813	
PV Unit electricity exported	-237.8853	5.8100	-13.8211	
Total			-127.1024	(252)
Total energy cost			662.8054	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	418.5003	0.1592	66.6275	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2439.8755	0.1413	344.7254	(264)
Space and water heating			411.3529	(265)
Pumps, fans and electric keep-hot	131.8098	0.1387	18.2836	(267)
Energy for lighting	149.3528	0.1443	21.5562	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-450.2436	0.1320	-59.4512	
PV Unit electricity exported	-237.8853	0.1226	-29.1704	
Total			-88.6216	(269)
Total CO2, kg/year			362.5711	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	418.5003	1.5892	665.0908	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2439.8755	1.5225	3714.5924	(278)
Space and water heating			4379.6831	(279)
Pumps, fans and electric keep-hot	131.8098	1.5128	199.4018	(281)
Energy for lighting	149.3528	1.5338	229.0823	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-450.2436	1.4879	-669.9030	
PV Unit electricity exported	-237.8853	0.4500	-107.0542	
Total			-776.9572	(283)
Total Primary energy kWh/year			4031.2101	(286)

SAP 10 EPC IMPROVEMENTS

Unit 414 L02_Copy

Current energy efficiency rating: C 78
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 78
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£790	£790	£0
Space heating	£138	£138	£0
Water heating	£614	£614	£0
Lighting	£38	£38	£0
Generated (PV)	-£127	-£127	£0
Total cost of fuels	£663	£663	£0
Total cost of uses	£663	£663	£0
Delivered energy	38 kWh/m²	38 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	63 kWh/m²	63 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.3100 (1b)	x	2.4000 (2b)	=	154.3440	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.3100					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	154.3440	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.2100	19.6900	24.5200	0.1400	3.4328	14.0000	343.2800	(29a)
Total net area of external elements Aum(A, m2)			44.2100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.7645			(33)
Party Wall 1			14.8500	0.0000	0.0000	20.0000	297.0000	(32)
Wall to corridor			29.3600	0.0000	0.0000	20.0000	587.2000	(32)
Party Floor 1			64.3100			80.0000	5144.8000	(32d)
Party Ceiling 1			64.3100			80.0000	5144.8000	(32b)
Internal Wall 1			98.7600			9.0000	888.8400	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12405.9200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 192.9081 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.3700	0.0700	1.1459
E18 Party wall between dwellings	2.7000	0.0600	0.1620
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	14.9200	0.0000	0.0000
E16 Corner (normal)	2.7000	0.0900	0.2430

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.1349 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 30.8994 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.4106	15.2482	15.0859	14.2741	14.1118	13.3000	13.3000	13.1377	13.6247	14.1118	14.4365	14.7612	(38)
Heat transfer coeff	46.3100	46.1477	45.9853	45.1736	45.0112	44.1995	44.1995	44.0371	44.5242	45.0112	45.3359	45.6606	(39)
Average = Sum(39)m / 12 =												45.1330	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7201	0.7176	0.7151	0.7024	0.6999	0.6873	0.6873	0.6848	0.6923	0.6999	0.7050	0.7100	(40)
HLP (average)												0.7018	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1005 (42)
Hot water usage for mixer showers

81.7276	80.4994	78.7097	75.2853	72.7583	69.9401	68.3382	70.1144	72.0615	75.0873	78.5852	81.4145	(42a)

Hot water usage for baths

25.6836	25.3022	24.7650	23.7747	23.0331	22.2107	21.7666	22.3000	22.8807	23.7606	24.7714	25.5968	(42b)

Hot water usage for other uses

36.1413	34.8271	33.5129	32.1986	30.8844	29.5702	29.5702	30.8844	32.1986	33.5129	34.8271	36.1413	(42c)

Average daily hot water use (litres/day) 132.0187 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.5526	140.6287	136.9876	131.2586	126.6757	121.7210	119.6750	123.2988	127.1408	132.3608	138.1837	143.1526	(44)
Energy conte	227.3522	200.2534	210.5448	179.6865	170.5299	149.6702	144.7365	152.6697	156.7773	179.6124	196.8681	224.1424	(45)
Energy content (annual)										Total = Sum(45)m =		2192.8435	
Distribution loss (46)m = 0.15 x (45)m	34.1028	30.0380	31.5817	26.9530	25.5795	22.4505	21.7105	22.9004	23.5166	26.9419	29.5302	33.6214	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(64)
										Total per year (kWh/year) = Sum(64)m =		2439.8755	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	92.3793	81.7446	86.7908	75.9890	73.4858	66.0085	64.9095	67.5473	68.3717	76.5058	81.7018	91.3120	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.1424	18.7785	15.2717	11.5617	8.6425	7.2964	7.8840	10.2479	13.7547	17.4647	20.3839	21.7301	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	274.1367	276.9814	269.8129	254.5520	235.2878	217.1823	205.0866	202.2419	209.4104	224.6713	243.9355	262.0411	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	(71)
Water heating gains (Table 5)	124.1657	121.6437	116.6543	105.5402	98.7713	91.6785	87.2440	90.7894	94.9607	102.8303	113.4748	122.7312	(72)
Total internal gains	511.1586	509.1174	493.4527	463.3677	434.4154	407.8709	391.9284	394.9930	409.8396	436.6802	469.5080	498.2161	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(79)
Northwest	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(81)

Solar gains	152.7958	276.2486	420.4233	592.0739	728.1137	751.4140	712.5556	606.6966	479.1778	316.7586	185.9245	128.8782	(83)
Total gains	663.9545	785.3661	913.8760	1055.4416	1162.5291	1159.2849	1104.4840	1001.6896	889.0173	753.4388	655.4324	627.0944	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	74.4135	74.6752	74.9389	76.2855	76.5607	77.9668	77.9668	78.2542	77.3982	76.5607	76.0123	75.4718	
alpha	5.9609	5.9783	5.9959	6.0857	6.1040	6.1978	6.1978	6.2169	6.1599	6.1040	6.0675	6.0315	
util living area	0.9129	0.8319	0.6961	0.5133	0.3596	0.2440	0.1761	0.2022	0.3452	0.6080	0.8411	0.9285	(86)
MIT	20.6238	20.7983	20.9311	20.9890	20.9988	20.9999	21.0000	21.0000	20.9993	20.9773	20.8219	20.5833	(87)
Th 2	20.3231	20.3253	20.3276	20.3387	20.3409	20.3521	20.3521	20.3543	20.3476	20.3409	20.3365	20.3320	(88)
util rest of house	0.8993	0.8114	0.6697	0.4863	0.3343	0.2193	0.1502	0.1738	0.3127	0.5728	0.8180	0.9169	(89)
MIT 2	19.9049	20.1099	20.2586	20.3287	20.3400	20.3520	20.3521	20.3543	20.3472	20.3210	20.1512	19.8644	(90)
Living area fraction									fLA = Living area / (4) =			0.3816	(91)
MIT	20.1792	20.3726	20.5152	20.5807	20.5914	20.5993	20.5993	20.6007	20.5960	20.5714	20.4071	20.1387	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1792	20.3726	20.5152	20.5807	20.5914	20.5993	20.5993	20.6007	20.5960	20.5714	20.4071	20.1387	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8962	0.8129	0.6772	0.4962	0.3439	0.2287	0.1600	0.1847	0.3251	0.5852	0.8206	0.9132	(94)
Useful gains	595.0388	638.4221	618.8617	523.7474	399.8206	265.1421	176.7657	184.9820	289.0372	440.9435	537.8315	572.6406	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	735.3680	714.0235	644.4936	527.6585	400.2118	265.1640	176.7674	184.9862	289.2306	448.8256	603.2915	727.7727	(97)
Space heating kWh	104.4049	50.8041	19.0701	2.8159	0.2910	0.0000	0.0000	0.0000	0.0000	5.8643	47.1312	115.4183	(98a)
Space heating requirement - total per year (kWh/year)												345.7999	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	104.4049	50.8041	19.0701	2.8159	0.2910	0.0000	0.0000	0.0000	0.0000	5.8643	47.1312	115.4183	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												345.7999	
Space heating per m2											(98c) / (4) =	5.3771	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	104.4049	50.8041	19.0701	2.8159	0.2910	0.0000	0.0000	0.0000	0.0000	5.8643	47.1312	115.4183	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	104.4049	50.8041	19.0701	2.8159	0.2910	0.0000	0.0000	0.0000	0.0000	5.8643	47.1312	115.4183	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.1948	10.1114	11.1948	10.8337	11.1948	10.8337	11.1948	11.1948	10.8337	11.1948	10.8337	11.1948	(231)
Lighting	18.5059	14.8461	13.3673	9.7934	7.5647	6.1804	6.9008	8.9699	11.6510	15.2868	17.2664	19.0202	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.4007	-24.4116	-39.4994	-49.6586	-58.3512	-56.1753	-55.2817	-49.8783	-40.7154	-29.7229	-17.7115	-12.9855	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.8931	-6.9495	-15.7665	-26.5116	-37.1419	-38.1716	-37.6311	-30.4564	-20.7964	-10.9074	-4.1606	-2.2017	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity)

(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year		
Space heating fuel - main system 1	345.7999	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2439.8755	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	131.8098	(230a)
Total electricity for the above, kWh/year	131.8098	(231)
Electricity for lighting (calculated in Appendix L)	149.3528	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-683.3800	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2383.4580	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	345.7999	16.4900	57.0224	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2439.8755	16.4900	402.3355	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	131.8098	16.4900	21.7354	(249)
Energy for lighting	149.3528	16.4900	24.6283	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-449.7921	16.4900	-74.1707	
PV Unit electricity exported	-233.5879	5.5900	-13.0576	
Total			-87.2283	(252)
Total energy cost			418.4933	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.3783	(257)
SAP value	77.6584	
SAP rating (Section 12)	78	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	345.7999	0.1597	55.2330	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2439.8755	0.1413	344.7254	(264)
Space and water heating			399.9584	(265)
Pumps, fans and electric keep-hot	131.8098	0.1387	18.2836	(267)
Energy for lighting	149.3528	0.1443	21.5562	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-449.7921	0.1323	-59.5275	
PV Unit electricity exported	-233.5879	0.1231	-28.7646	
Total			-88.2920	(269)
Total CO2, kg/year			351.5063	(272)
CO2 emissions per m2			5.4700	(273)
EI value			95.6910	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		64.3100 (1b)	x	2.4000 (2b)	=	154.3440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.3100						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		154.3440	(5)

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2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.2100	19.6900	24.5200	0.1400	3.4328	14.0000	343.2800	(29a)
Total net area of external elements Aum(A, m2)			44.2100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.7645			(33)
Party Wall 1			14.8500	0.0000	0.0000	20.0000	297.0000	(32)
Wall to corridor			29.3600	0.0000	0.0000	20.0000	587.2000	(32)
Party Floor 1			64.3100			80.0000	5144.8000	(32d)
Party Ceiling 1			64.3100			80.0000	5144.8000	(32b)
Internal Wall 1			98.7600			9.0000	888.8400	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12405.9200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		192.9081 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.3700	0.0700	1.1459
E18 Party wall between dwellings	2.7000	0.0600	0.1620
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	14.9200	0.0000	0.0000
E16 Corner (normal)	2.7000	0.0900	0.2430

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.1349 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	30.8994 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.5729	15.5729	15.2482	14.2741	14.1118	13.4624	13.1377	13.1377	13.7871	14.5988	14.9235	14.7612	(38)
Heat transfer coeff	46.4724	46.4724	46.1477	45.1736	45.0112	44.3618	44.0371	44.0371	44.6865	45.4983	45.8230	45.6606	(39)
Average = Sum(39)m / 12 =												45.2818	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7226	0.7226	0.7176	0.7024	0.6999	0.6898	0.6848	0.6848	0.6949	0.7075	0.7125	0.7100	(40)
HLP (average)												0.7041	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.1005 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
81.7276	80.4994	78.7097	75.2853	72.7583	69.9401	68.3382	70.1144	72.0615	75.0873	78.5852	81.4145	(42a)

Hot water usage for baths

25.6836	25.3022	24.7650	23.7747	23.0331	22.2107	21.7666	22.3000	22.8807	23.7606	24.7714	25.5968	(42b)

Hot water usage for other uses

36.1413	34.8271	33.5129	32.1986	30.8844	29.5702	29.5702	30.8844	32.1986	33.5129	34.8271	36.1413	(42c)

Average daily hot water use (litres/day)	132.0187 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.5526	140.6287	136.9876	131.2586	126.6757	121.7210	119.6750	123.2988	127.1408	132.3608	138.1837	143.1526	(44)
Energy conte	227.3522	200.2534	210.5448	179.6865	170.5299	149.6702	144.7365	152.6697	156.7773	179.6124	196.8681	224.1424	(45)
Energy content (annual)										Total = Sum(45)m =		2192.8435	
Distribution loss (46)m = 0.15 x (45)m	34.1028	30.0380	31.5817	26.9530	25.5795	22.4505	21.7105	22.9004	23.5166	26.9419	29.5302	33.6214	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(64)
									Total per year (kWh/year) = Sum(64)m =			2439.8755	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month													
	92.3793	81.7446	86.7908	75.9890	73.4858	66.0085	64.9095	67.5473	68.3717	76.5058	81.7018	91.3120	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	126.0307	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.1424	18.7785	15.2717	11.5617	8.6425	7.2964	7.8840	10.2479	13.7547	17.4647	20.3839	21.7301	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	274.1367	276.9814	269.8129	254.5520	235.2878	217.1823	205.0866	202.2419	209.4104	224.6713	243.9355	262.0411	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	49.7036	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	-84.0205	(71)
Water heating gains (Table 5)													
	124.1657	121.6437	116.6543	105.5402	98.7713	91.6785	87.2440	90.7894	94.9607	102.8303	113.4748	122.7312	(72)
Total internal gains													
	511.1586	509.1174	493.4527	463.3677	434.4154	407.8709	391.9284	394.9930	409.8396	436.6802	469.5080	498.2161	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(79)
Northwest	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(81)

Solar gains	137.9782	265.6866	421.5549	624.1600	760.9473	764.1300	733.2127	606.0620	475.9114	302.5081	172.4386	119.0880	(83)
Total gains	649.1368	774.8041	915.0076	1087.5277	1195.3628	1172.0009	1125.1411	1001.0551	885.7510	739.1883	641.9466	617.3041	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	74.1535	74.1535	74.6752	76.2855	76.5607	77.6814	78.2542	78.2542	77.1170	75.7411	75.2044	75.4718	
alpha	5.9436	5.9436	5.9783	6.0857	6.1040	6.1788	6.2169	6.2169	6.1411	6.0494	6.0136	6.0315	
util living area													
	0.9271	0.8567	0.7305	0.5380	0.3871	0.2951	0.2387	0.2727	0.4126	0.6700	0.8689	0.9400	(86)
MIT	20.5665	20.7475	20.9049	20.9848	20.9980	20.9997	20.9999	20.9999	20.9978	20.9574	20.7701	20.5273	(87)
Th 2	20.3209	20.3209	20.3253	20.3387	20.3409	20.3498	20.3543	20.3543	20.3454	20.3342	20.3298	20.3320	(88)
util rest of house													
	0.9154	0.8384	0.7058	0.5121	0.3626	0.2706	0.2135	0.2443	0.3800	0.6362	0.8486	0.9301	(89)
MIT 2	19.8337	20.0470	20.2278	20.3244	20.3393	20.3496	20.3543	20.3542	20.3438	20.2950	20.0859	19.7960	(90)
Living area fraction										fLA = Living area / (4) =		0.3816	(91)
MIT	20.1133	20.3143	20.4862	20.5764	20.5906	20.5977	20.6007	20.6006	20.5934	20.5478	20.3470	20.0750	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1133	20.3143	20.4862	20.5764	20.5906	20.5977	20.6007	20.6006	20.5934	20.5478	20.3470	20.0750	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9114	0.8382	0.7118	0.5215	0.3719	0.2799	0.2231	0.2551	0.3924	0.6472	0.8492	0.9258	(94)
Useful gains	591.6487	649.4336	651.2843	567.1101	444.5162	328.0844	251.0229	255.4024	347.5726	478.4320	545.1349	571.5150	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	753.4718	744.2246	686.9624	572.6379	445.1895	328.1751	251.0403	255.4414	348.2578	493.5547	629.9265	747.6945	(97)
Space heating kWh													
	120.3964	63.6995	26.5445	3.9801	0.5010	0.0000	0.0000	0.0000	0.0000	11.2513	61.0500	131.0776	(98a)
Space heating requirement - total per year (kWh/year)												418.5003	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	120.3964	63.6995	26.5445	3.9801	0.5010	0.0000	0.0000	0.0000	0.0000	11.2513	61.0500	131.0776	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												418.5003	
Space heating per m2											(98c) / (4) =	6.5075	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	120.3964	63.6995	26.5445	3.9801	0.5010	0.0000	0.0000	0.0000	0.0000	11.2513	61.0500	131.0776	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	120.3964	63.6995	26.5445	3.9801	0.5010	0.0000	0.0000	0.0000	0.0000	11.2513	61.0500	131.0776	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	248.3330	219.2038	231.5256	199.9905	191.5107	169.9742	165.7173	173.6505	177.0813	200.5932	217.1721	245.1232	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.1948	10.1114	11.1948	10.8337	11.1948	10.8337	11.1948	11.1948	10.8337	11.1948	10.8337	11.1948	(231)
Lighting	18.5059	14.8461	13.3673	9.7934	7.5647	6.1804	6.9008	8.9699	11.6510	15.2868	17.2664	19.0202	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-13.9632	-23.5442	-39.5900	-51.7924	-60.4179	-56.9935	-56.5645	-49.8935	-40.4465	-28.5276	-16.4999	-12.0106	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4329	-6.4348	-15.6570	-28.5444	-39.6226	-39.2313	-39.3039	-30.4736	-20.5513	-10.0788	-3.6407	-1.9141	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1	418.5003	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2439.8755	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	131.8098	(230a)
Total electricity for the above, kWh/year	131.8098	(231)
Electricity for lighting (calculated in Appendix L)	149.3528	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-688.1289	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2451.4094	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	418.5003	25.1600	105.2947	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2439.8755	25.1600	613.8727	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	131.8098	25.1600	33.1633	(249)
Energy for lighting	149.3528	25.1600	37.5772	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-450.2436	25.1600	-113.2813	
PV Unit electricity exported	-237.8853	5.8100	-13.8211	
Total			-127.1024	(252)
Total energy cost			662.8054	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	418.5003	0.1592	66.6275	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2439.8755	0.1413	344.7254	(264)
Space and water heating			411.3529	(265)
Pumps, fans and electric keep-hot	131.8098	0.1387	18.2836	(267)
Energy for lighting	149.3528	0.1443	21.5562	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-450.2436	0.1320	-59.4512	
PV Unit electricity exported	-237.8853	0.1226	-29.1704	
Total			-88.6216	(269)
Total CO2, kg/year			362.5711	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	418.5003	1.5892	665.0908	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2439.8755	1.5225	3714.5924	(278)
Space and water heating			4379.6831	(279)
Pumps, fans and electric keep-hot	131.8098	1.5128	199.4018	(281)
Energy for lighting	149.3528	1.5338	229.0823	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-450.2436	1.4879	-669.9030	
PV Unit electricity exported	-237.8853	0.4500	-107.0542	
Total			-776.9572	(283)
Total Primary energy kWh/year			4031.2101	(286)

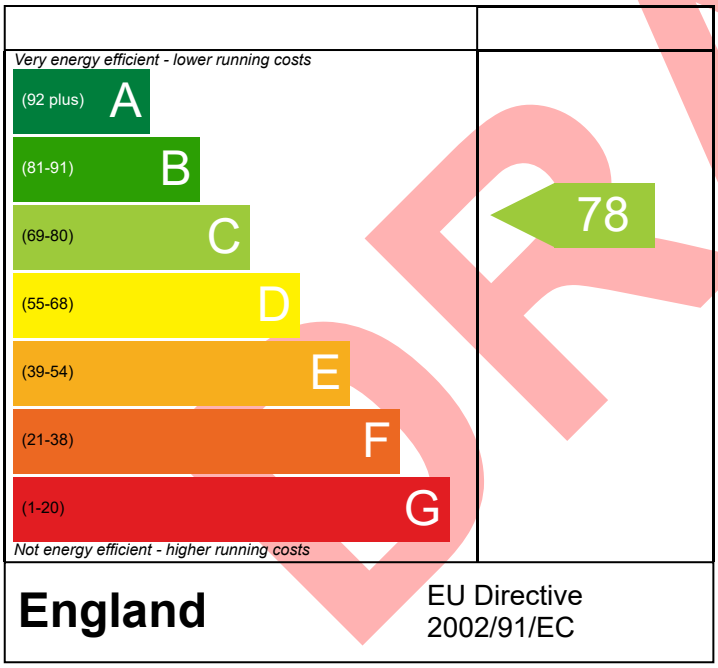
Predicted Energy Assessment

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	64.31 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

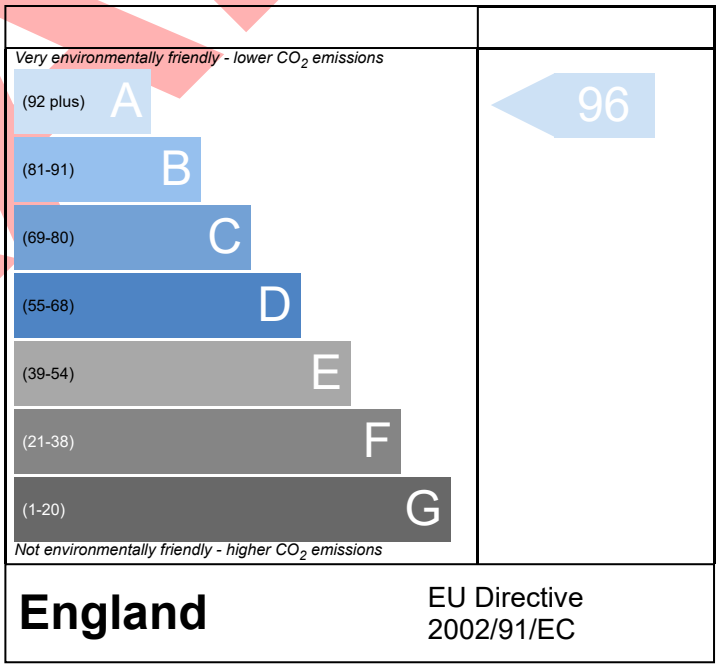
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:29

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	46 m^2
Site Reference	Unit 415 L02_Copy	Plot Reference	Unit 415 L02_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*12.06 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	5.84 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*65.63 kWh$_{PE}$/m^2*	
Dwelling primary energy	65.47 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*13.9 kWh/m^2*	
Dwelling fabric energy efficiency	12.7 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	8.88	0.14 **(!)**
Party wall: Party Wall (1)	23.22	0 **(!)**
Party wall: Party Wall (2)	39.28	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	7.18	South West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.59 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 415 L02_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 415 L02_Copy	**Prop Type Ref**	Unit 415 L02
Property			

SAP Rating	79 C	**DER**	5.84	**TER**	12.06
Environmental	96 A	**% DER < TER**			51.58
CO_2 Emissions (t/year)	0.27	**DFEE**	12.73	**TFEE**	13.86
Compliance Check	See BREL	**% DFEE < TFEE**			8.13
% DPER < TPER	0.25	**DPER**	65.47	**TPER**	65.63

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.9900	(1b)	x 2.4000	(2b) =	110.3760	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.9900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		110.3760	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.1800	1.2357	8.8726			(27)
External Wall 1	16.0600	7.1800	8.8800	0.1400	1.2432	14.0000	124.3200	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.1158			(33)
Party Wall 1			23.2200	0.0000	0.0000	20.0000	464.4000	(32)
Wall to corridor			39.2800	0.0000	0.0000	20.0000	785.6000	(32)
Party Floor 1			45.9900			80.0000	3679.2000	(32d)
Party Ceiling 1			45.9900			80.0000	3679.2000	(32b)
Internal Wall 1			66.6300			9.0000	599.6700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9332.3900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.9222 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.0900	0.0500	0.1545

E4 Jamb	18.5600	0.0500	0.9280	
E7 Party floor between dwellings (in blocks of flats)	11.9000	0.0700	0.8330	
E18 Party wall between dwellings	2.7000	0.0600	0.1620	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	46.3000	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.0775 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 12.1933 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	10.4981	10.3922	10.2864	9.7571	9.6512	9.1220	9.1220	9.0161	9.3337	9.6512	9.8630	10.0747	(38)
Heat transfer coeff	22.6914	22.5856	22.4797	21.9504	21.8446	21.3153	21.3153	21.2094	21.5270	21.8446	22.0563	22.2680	(39)

Average = Sum(39)m / 12 = 21.9240

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4934	0.4911	0.4888	0.4773	0.4750	0.4635	0.4635	0.4612	0.4681	0.4750	0.4796	0.4842	(40)
HLP (average)												0.4767	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.5731 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	69.5673	68.5219	66.9984	64.0836	61.9325	59.5337	58.1702	59.6821	61.3394	63.9151	66.8925	69.3008	(42a)
Hot water usage for baths	21.8805	21.5555	21.0979	20.2542	19.6224	18.9219	18.5435	18.9979	19.4926	20.2422	21.1034	21.8065	(42b)
Hot water usage for other uses	30.7397	29.6219	28.5041	27.3863	26.2684	25.1506	25.1506	26.2684	27.3863	28.5041	29.6219	30.7397	(42c)

Average daily hot water use (litres/day) 112.3706 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	122.1875	119.6993	116.6004	111.7240	107.8234	103.6062	101.8643	104.9484	108.2183	112.6614	117.6177	121.8470	(44)
Energy conte	193.5151	170.4502	179.2105	152.9446	145.1510	127.3959	123.1960	129.9480	133.4440	152.8804	167.5680	190.7830	(45)

Energy content (annual) Total = Sum(45)m = 1866.4867

Distribution loss (46)m = 0.15 x (45)m	29.0273	25.5675	26.8816	22.9417	21.7726	19.1094	18.4794	19.4922	20.0166	22.9321	25.1352	28.6174	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(64)

Total per year (kWh/year) = Sum(64)m = 2113.5187 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	81.1284	71.8350	76.3721	67.0973	65.0473	58.6023	57.7473	59.9924	60.6133	67.6174	71.9596	80.2200	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.0271	14.2351	11.5768	8.7644	6.5515	5.5310	5.9765	7.7684	10.4268	13.2392	15.4521	16.4725	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	204.2328	206.3521	201.0115	189.6421	175.2902	161.8015	152.7902	150.6709	156.0115	167.3809	181.7328	195.2215	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	(71)
Water heating gains (Table 5)	109.0436	106.8973	102.6507	93.1907	87.4292	81.3921	77.6173	80.6349	84.1852	90.8836	99.9438	107.8225	(72)
Total internal gains	406.7760	404.9571	392.7115	369.0697	346.7435	326.1972	313.8566	316.5468	328.0960	348.9762	374.6012	396.9891	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.1800	36.7938	0.6300	0.8270	0.7700	95.3847	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	95.3847	162.4755	222.3060	275.4479	308.5246	306.2935	295.2996	270.6229	240.7104	179.5700	114.2489	81.6294	(83)
Total gains	502.1607	567.4325	615.0175	644.5176	655.2681	632.4907	609.1562	587.1697	568.8063	528.5462	488.8501	478.6185	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.2427	114.7782	115.3187	118.0993	118.6716	121.6184	121.6184	122.2254	120.4223	118.6716	117.5325	116.4151	
alpha	8.6162	8.6519	8.6879	8.8733	8.9114	9.1079	9.1079	9.1484	9.0282	8.9114	8.8355	8.7610	
util living area													
	0.7371	0.6359	0.5290	0.4120	0.3100	0.2157	0.1540	0.1662	0.2611	0.4297	0.6233	0.7600	(86)
MIT	20.9719	20.9910	20.9980	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9998	20.9940	20.9669	(87)
Th 2	20.5269	20.5290	20.5311	20.5417	20.5438	20.5544	20.5544	20.5565	20.5502	20.5438	20.5396	20.5353	(88)
util rest of house													
	0.7190	0.6182	0.5121	0.3964	0.2948	0.2007	0.1384	0.1501	0.2441	0.4109	0.6035	0.7423	(89)
MIT 2	20.4977	20.5199	20.5292	20.5415	20.5438	20.5544	20.5544	20.5565	20.5502	20.5436	20.5338	20.5006	(90)
Living area fraction										fLA = Living area / (4) =		0.5849	(91)
MIT	20.7751	20.7955	20.8034	20.8096	20.8106	20.8150	20.8150	20.8159	20.8133	20.8104	20.8030	20.7733	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7751	20.7955	20.8034	20.8096	20.8106	20.8150	20.8150	20.8159	20.8133	20.8104	20.8030	20.7733	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7286	0.6282	0.5219	0.4055	0.3037	0.2095	0.1475	0.1595	0.2541	0.4219	0.6149	0.7514	(94)
Useful gains	365.8603	356.4654	320.9877	261.3685	199.0144	132.4754	89.8449	93.6593	144.5163	222.9834	300.5738	359.6485	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	373.8430	359.0083	321.5369	261.4203	199.0178	132.4754	89.8449	93.6593	144.5168	223.0425	302.2367	369.0553	(97)
Space heating kWh													
	5.9391	1.7088	0.4086	0.0373	0.0025	0.0000	0.0000	0.0000	0.0000	0.0439	1.1973	6.9986	(98a)
Space heating requirement - total per year (kWh/year)												16.3362	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	5.9391	1.7088	0.4086	0.0373	0.0025	0.0000	0.0000	0.0000	0.0000	0.0439	1.1973	6.9986	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												16.3362	
Space heating per m2											(98c) / (4) =	0.3552	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	5.9391	1.7088	0.4086	0.0373	0.0025	0.0000	0.0000	0.0000	0.0000	0.0439	1.1973	6.9986	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	5.9391	1.7088	0.4086	0.0373	0.0025	0.0000	0.0000	0.0000	0.0000	0.0439	1.1973	6.9986	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.0057	7.2310	8.0057	7.7475	8.0057	7.7475	8.0057	8.0057	7.7475	8.0057	7.7475	8.0057	(231)
Lighting	14.0284	11.2541	10.1331	7.4239	5.7345	4.6851	5.2312	6.7997	8.8321	11.5882	13.0888	14.4183	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.9038	-17.4116	-28.5123	-36.2317	-42.8143	-41.3038	-40.6546	-36.5886	-29.7380	-21.5193	-12.6345	-9.1831	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.1002	-4.8812	-10.7731	-17.9133	-25.0663	-25.7620	-25.3918	-20.5168	-13.9872	-7.3625	-2.9132	-1.6126	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	16.3362	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2113.5187	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	94.2611	(230a)
Total electricity for the above, kWh/year	94.2611	(231)
Electricity for lighting (calculated in Appendix L)	113.2174	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-485.7761	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1851.5572	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	16.3362	16.4900	2.6938	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2113.5187	16.4900	348.5192	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	94.2611	16.4900	15.5437	(249)
Energy for lighting	113.2174	16.4900	18.6696	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-327.4960	16.4900	-54.0041	
PV Unit electricity exported	-158.2802	5.5900	-8.8479	
Total			-62.8519	(252)
Total energy cost			322.5743	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2763	(257)
SAP value		79.3119	
SAP rating (Section 12)		79	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	16.3362	0.1614	2.6372	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2113.5187	0.1412	298.5203	(264)
Space and water heating			301.1575	(265)
Pumps, fans and electric keep-hot	94.2611	0.1387	13.0752	(267)
Energy for lighting	113.2174	0.1443	16.3408	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-327.4960	0.1322	-43.2846	
PV Unit electricity exported	-158.2802	0.1234	-19.5382	
Total			-62.8227	(269)
Total CO2, kg/year			267.7507	(272)
CO2 emissions per m2			5.8200	(273)
EI value			96.0569	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		45.9900 (1b)	x	2.4000 (2b)	=	110.3760	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.9900						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	110.3760	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.1800	1.2357	8.8726			(27)
External Wall 1	16.0600	7.1800	8.8800	0.1400	1.2432	14.0000	124.3200	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.1158			(33)
Party Wall 1			23.2200	0.0000	0.0000	20.0000	464.4000	(32)
Wall to corridor			39.2800	0.0000	0.0000	20.0000	785.6000	(32)
Party Floor 1			45.9900			80.0000	3679.2000	(32d)
Party Ceiling 1			45.9900			80.0000	3679.2000	(32b)
Internal Wall 1			66.6300			9.0000	599.6700	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9332.3900 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 202.9222 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	3.0900	0.0500	0.1545
E4	Jamb	18.5600	0.0500	0.9280
E7	Party floor between dwellings (in blocks of flats)	11.9000	0.0700	0.8330
E18	Party wall between dwellings	2.7000	0.0600	0.1620
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	46.3000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.0775 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 12.1933 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	10.6040	10.6040	10.3922	9.7571	9.6512	9.2278	9.0161	9.0161	9.4395	9.9688	10.1805	10.0747	(38)
Heat transfer coeff	22.7973	22.7973	22.5856	21.9504	21.8446	21.4211	21.2094	21.2094	21.6329	22.1621	22.3739	22.2680	(39)

Average = Sum(39)m / 12 = 22.0210

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4957	0.4957	0.4911	0.4773	0.4750	0.4658	0.4612	0.4612	0.4704	0.4819	0.4865	0.4842	(40)
HLP (average)												0.4788	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.5731 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	69.5673	68.5219	66.9984	64.0836	61.9325	59.5337	58.1702	59.6821	61.3394	63.9151	66.8925	69.3008	(42a)
Hot water usage for baths	21.8805	21.5555	21.0979	20.2542	19.6224	18.9219	18.5435	18.9979	19.4926	20.2422	21.1034	21.8065	(42b)
Hot water usage for other uses	30.7397	29.6219	28.5041	27.3863	26.2684	25.1506	25.1506	26.2684	27.3863	28.5041	29.6219	30.7397	(42c)

Average daily hot water use (litres/day) 112.3706 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	122.1875	119.6993	116.6004	111.7240	107.8234	103.6062	101.8643	104.9484	108.2183	112.6614	117.6177	121.8470	(44)
Energy conte	193.5151	170.4502	179.2105	152.9446	145.1510	127.3959	123.1960	129.9480	133.4440	152.8804	167.5680	190.7830	(45)
Energy content (annual)										Total = Sum(45)m =		1866.4867	
Distribution loss (46)m = 0.15 x (45)m	29.0273	25.5675	26.8816	22.9417	21.7726	19.1094	18.4794	19.4922	20.0166	22.9321	25.1352	28.6174	(46)

Water storage loss:

Store volume 143.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)

Temperature factor from Table 2b 0.6000 (49)

Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(64)
									Total per year (kWh/year) = Sum(64)m =			2113.5187	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	81.1284	71.8350	76.3721	67.0973	65.0473	58.6023	57.7473	59.9924	60.6133	67.6174	71.9596	80.2200	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.0271	14.2351	11.5768	8.7644	6.5515	5.5310	5.9765	7.7684	10.4268	13.2392	15.4521	16.4725	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	204.2328	206.3521	201.0115	189.6421	175.2902	161.8015	152.7902	150.6709	156.0115	167.3809	181.7328	195.2215	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	(71)
Water heating gains (Table 5)													
	109.0436	106.8973	102.6507	93.1907	87.4292	81.3921	77.6173	80.6349	84.1852	90.8836	99.9438	107.8225	(72)
Total internal gains													
	406.7760	404.9571	392.7115	369.0697	346.7435	326.1972	313.8566	316.5468	328.0960	348.9762	374.6012	396.9891	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.1800	33.4622	0.6300	0.8270	0.7700	86.7478	(79)

Solar gains	86.7478	157.7089	225.5139	293.9220	325.8839	314.4382	306.9161	273.5144	241.9971	173.2574	106.7816	75.9203	(83)
Total gains	493.5238	562.6659	618.2254	662.9917	672.6273	640.6354	620.7726	590.0612	570.0931	522.2336	481.3828	472.9094	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	113.7123	113.7123	114.7782	118.0993	118.6716	121.0174	122.2254	122.2254	119.8330	116.9711	115.8643	116.4151	
alpha	8.5808	8.5808	8.6519	8.8733	8.9114	9.0678	9.1484	9.1484	8.9889	8.7981	8.7243	8.7610	
util living area													
	0.7654	0.6688	0.5609	0.4336	0.3345	0.2608	0.2084	0.2229	0.3112	0.4792	0.6625	0.7856	(86)
MIT	20.9615	20.9859	20.9966	20.9997	21.0000	21.0000	21.0000	21.0000	21.0000	20.9994	20.9896	20.9563	(87)
Th 2	20.5248	20.5248	20.5290	20.5417	20.5438	20.5523	20.5565	20.5565	20.5481	20.5375	20.5332	20.5353	(88)
util rest of house													
	0.7479	0.6511	0.5441	0.4184	0.3197	0.2458	0.1933	0.2069	0.2940	0.4596	0.6424	0.7688	(89)
MIT 2	20.4843	20.5104	20.5257	20.5414	20.5438	20.5523	20.5565	20.5565	20.5480	20.5369	20.5229	20.4889	(90)
Living area fraction										fLA = Living area / (4) =		0.5849	(91)
MIT	20.7634	20.7885	20.8012	20.8095	20.8106	20.8142	20.8159	20.8159	20.8124	20.8074	20.7959	20.7623	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7634	20.7885	20.8012	20.8095	20.8106	20.8142	20.8159	20.8159	20.8124	20.8074	20.7959	20.7623	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7568	0.6609	0.5538	0.4273	0.3283	0.2546	0.2021	0.2162	0.3040	0.4710	0.6537	0.7771	(94)
Useful gains	373.4742	371.8934	342.3822	283.2820	220.8548	163.1035	125.4734	127.5943	173.3282	245.9893	314.6931	367.4971	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	384.4399	375.8937	343.3267	283.3681	220.8620	163.1040	125.4734	127.5943	173.3309	246.1635	317.6160	379.9425	(97)
Space heating kWh													
	8.1585	2.6882	0.7027	0.0619	0.0054	0.0000	0.0000	0.0000	0.0000	0.1295	2.1045	9.2594	(98a)
Space heating requirement - total per year (kWh/year)												23.1102	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	8.1585	2.6882	0.7027	0.0619	0.0054	0.0000	0.0000	0.0000	0.0000	0.1295	2.1045	9.2594	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												23.1102	
Space heating per m2										(98c) / (4) =		0.5025	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	8.1585	2.6882	0.7027	0.0619	0.0054	0.0000	0.0000	0.0000	0.0000	0.1295	2.1045	9.2594	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	8.1585	2.6882	0.7027	0.0619	0.0054	0.0000	0.0000	0.0000	0.0000	0.1295	2.1045	9.2594	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.0057	7.2310	8.0057	7.7475	8.0057	7.7475	8.0057	8.0057	7.7475	8.0057	7.7475	8.0057	(231)

Lighting	14.0284	11.2541	10.1331	7.4239	5.7345	4.6851	5.2312	6.7997	8.8321	11.5882	13.0888	14.4183	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-9.8713	-16.7438	-28.5078	-37.7931	-44.3587	-41.9198	-41.6208	-36.6000	-29.5382	-20.6038	-11.7373	-8.4828	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.7837	-4.5666	-10.7642	-19.3138	-26.7544	-26.4809	-26.5266	-20.5284	-13.8216	-6.8393	-2.5795	-1.4155	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	23.1102	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2113.5187	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	94.2611	(230a)
Total electricity for the above, kWh/year	94.2611	(231)
Electricity for lighting (calculated in Appendix L)	113.2174	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-489.1519	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1854.9555	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	23.1102	25.1600	5.8145	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2113.5187	25.1600	531.7613	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	94.2611	25.1600	23.7161	(249)
Energy for lighting	113.2174	25.1600	28.4855	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-327.7774	25.1600	-82.4688	
PV Unit electricity exported	-161.3745	5.8100	-9.3759	
Total			-91.8446	(252)
Total energy cost			497.9328	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	23.1102	0.1610	3.7217	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2113.5187	0.1412	298.5203	(264)
Space and water heating			302.2420	(265)
Pumps, fans and electric keep-hot	94.2611	0.1387	13.0752	(267)
Energy for lighting	113.2174	0.1443	16.3408	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-327.7774	0.1319	-43.2198	
PV Unit electricity exported	-161.3745	0.1230	-19.8429	
Total			-63.0626	(269)
Total CO2, kg/year			268.5953	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	23.1102	1.5959	36.8826	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2113.5187	1.5223	3217.3749	(278)
Space and water heating			3254.2575	(279)
Pumps, fans and electric keep-hot	94.2611	1.5128	142.5982	(281)
Energy for lighting	113.2174	1.5338	173.6566	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-327.7774	1.4872	-487.4614	
PV Unit electricity exported	-161.3745	0.4513	-72.8228	
Total			-560.2841	(283)
Total Primary energy kWh/year			3010.2282	(286)

SAP 10 EPC IMPROVEMENTS

Unit 415 L02_Copy

Current energy efficiency rating: C 79
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 79
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£590	£590	£0
Space heating	£30	£30	£0
Water heating	£532	£532	£0
Lighting	£28	£28	£0
Generated (PV)	-£92	-£92	£0
Total cost of fuels	£498	£498	£0
Total cost of uses	£498	£498	£0
Delivered energy	40 kWh/m²	40 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	65 kWh/m²	65 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.9900 (1b)	x	2.4000 (2b)	=	110.3760	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.9900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	110.3760	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.1800	1.2357	8.8726			(27)
External Wall 1	16.0600	7.1800	8.8800	0.1400	1.2432	14.0000	124.3200	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.1158			(33)
Party Wall 1			23.2200	0.0000	0.0000	20.0000	464.4000	(32)
Wall to corridor			39.2800	0.0000	0.0000	20.0000	785.6000	(32)
Party Floor 1			45.9900			80.0000	3679.2000	(32d)
Party Ceiling 1			45.9900			80.0000	3679.2000	(32b)
Internal Wall 1			66.6300			9.0000	599.6700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9332.3900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.9222 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.0900	0.0500	0.1545
E4 Jamb	18.5600	0.0500	0.9280
E7 Party floor between dwellings (in blocks of flats)	11.9000	0.0700	0.8330
E18 Party wall between dwellings	2.7000	0.0600	0.1620
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	46.3000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		2.0775 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	12.1933 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	10.4981	10.3922	10.2864	9.7571	9.6512	9.1220	9.1220	9.0161	9.3337	9.6512	9.8630	10.0747	(38)
Heat transfer coeff	22.6914	22.5856	22.4797	21.9504	21.8446	21.3153	21.3153	21.2094	21.5270	21.8446	22.0563	22.2680	(39)
Average = Sum(39)m / 12 =												21.9240	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4934	0.4911	0.4888	0.4773	0.4750	0.4635	0.4635	0.4612	0.4681	0.4750	0.4796	0.4842	(40)
HLP (average)												0.4767	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.5731 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
69.5673	68.5219	66.9984	64.0836	61.9325	59.5337	58.1702	59.6821	61.3394	63.9151	66.8925	69.3008	(42a)

Hot water usage for baths

21.8805	21.5555	21.0979	20.2542	19.6224	18.9219	18.5435	18.9979	19.4926	20.2422	21.1034	21.8065	(42b)

Hot water usage for other uses

30.7397	29.6219	28.5041	27.3863	26.2684	25.1506	25.1506	26.2684	27.3863	28.5041	29.6219	30.7397	(42c)

Average daily hot water use (litres/day)		112.3706 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	122.1875	119.6993	116.6004	111.7240	107.8234	103.6062	101.8643	104.9484	108.2183	112.6614	117.6177	121.8470	(44)
Energy conte	193.5151	170.4502	179.2105	152.9446	145.1510	127.3959	123.1960	129.9480	133.4440	152.8804	167.5680	190.7830	(45)
Energy content (annual)										Total = Sum(45)m =		1866.4867	
Distribution loss (46)m = 0.15 x (45)m	29.0273	25.5675	26.8816	22.9417	21.7726	19.1094	18.4794	19.4922	20.0166	22.9321	25.1352	28.6174	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(64)

	Total per year (kWh/year) = Sum(64)m =	2113.5187 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000 (64a)

Heat gains from water heating, kWh/month

81.1284	71.8350	76.3721	67.0973	65.0473	58.6023	57.7473	59.9924	60.6133	67.6174	71.9596	80.2200	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.0271	14.2351	11.5768	8.7644	6.5515	5.5310	5.9765	7.7684	10.4268	13.2392	15.4521	16.4725	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	204.2328	206.3521	201.0115	189.6421	175.2902	161.8015	152.7902	150.6709	156.0115	167.3809	181.7328	195.2215	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	(71)
Water heating gains (Table 5)	109.0436	106.8973	102.6507	93.1907	87.4292	81.3921	77.6173	80.6349	84.1852	90.8836	99.9438	107.8225	(72)
Total internal gains	406.7760	404.9571	392.7115	369.0697	346.7435	326.1972	313.8566	316.5468	328.0960	348.9762	374.6012	396.9891	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.1800	36.7938	0.6300	0.8270	0.7700	95.3847	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	95.3847	162.4755	222.3060	275.4479	308.5246	306.2935	295.2996	270.6229	240.7104	179.5700	114.2489	81.6294	(83)
Total gains	502.1607	567.4325	615.0175	644.5176	655.2681	632.4907	609.1562	587.1697	568.8063	528.5462	488.8501	478.6185	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.2427	114.7782	115.3187	118.0993	118.6716	121.6184	121.6184	122.2254	120.4223	118.6716	117.5325	116.4151	
alpha	8.6162	8.6519	8.6879	8.8733	8.9114	9.1079	9.1079	9.1484	9.0282	8.9114	8.8355	8.7610	
util living area	0.7371	0.6359	0.5290	0.4120	0.3100	0.2157	0.1540	0.1662	0.2611	0.4297	0.6233	0.7600	(86)
MIT	20.9719	20.9910	20.9980	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9998	20.9940	20.9669	(87)
Th 2	20.5269	20.5290	20.5311	20.5417	20.5438	20.5544	20.5544	20.5565	20.5502	20.5438	20.5396	20.5353	(88)
util rest of house	0.7190	0.6182	0.5121	0.3964	0.2948	0.2007	0.1384	0.1501	0.2441	0.4109	0.6035	0.7423	(89)
MIT 2	20.4977	20.5199	20.5292	20.5415	20.5438	20.5544	20.5544	20.5565	20.5502	20.5436	20.5338	20.5006	(90)
Living area fraction									fLA = Living area / (4) =			0.5849	(91)
MIT	20.7751	20.7955	20.8034	20.8096	20.8106	20.8150	20.8150	20.8159	20.8133	20.8104	20.8030	20.7733	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7751	20.7955	20.8034	20.8096	20.8106	20.8150	20.8150	20.8159	20.8133	20.8104	20.8030	20.7733	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7286	0.6282	0.5219	0.4055	0.3037	0.2095	0.1475	0.1595	0.2541	0.4219	0.6149	0.7514	(94)
Useful gains	365.8603	356.4654	320.9877	261.3685	199.0144	132.4754	89.8449	93.6593	144.5163	222.9834	300.5738	359.6485	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	373.8430	359.0083	321.5369	261.4203	199.0178	132.4754	89.8449	93.6593	144.5168	223.0425	302.2367	369.0553	(97)
Space heating kWh	5.9391	1.7088	0.4086	0.0373	0.0025	0.0000	0.0000	0.0000	0.0000	0.0439	1.1973	6.9986	(98a)
Space heating requirement - total per year (kWh/year)												16.3362	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	5.9391	1.7088	0.4086	0.0373	0.0025	0.0000	0.0000	0.0000	0.0000	0.0439	1.1973	6.9986	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												16.3362	
Space heating per m2											(98c) / (4) =	0.3552	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	5.9391	1.7088	0.4086	0.0373	0.0025	0.0000	0.0000	0.0000	0.0000	0.0439	1.1973	6.9986	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	5.9391	1.7088	0.4086	0.0373	0.0025	0.0000	0.0000	0.0000	0.0000	0.0439	1.1973	6.9986	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.0057	7.2310	8.0057	7.7475	8.0057	7.7475	8.0057	8.0057	7.7475	8.0057	7.7475	8.0057	(231)
Lighting	14.0284	11.2541	10.1331	7.4239	5.7345	4.6851	5.2312	6.7997	8.8321	11.5882	13.0888	14.4183	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.9038	-17.4116	-28.5123	-36.2317	-42.8143	-41.3038	-40.6546	-36.5886	-29.7380	-21.5193	-12.6345	-9.1831	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.1002	-4.8812	-10.7731	-17.9133	-25.0663	-25.7620	-25.3918	-20.5168	-13.9872	-7.3625	-2.9132	-1.6126	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												16.3362	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2113.5187	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	94.2611	(230a)
Total electricity for the above, kWh/year	94.2611	(231)
Electricity for lighting (calculated in Appendix L)	113.2174	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-485.7761	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1851.5572	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	16.3362	16.4900	2.6938	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2113.5187	16.4900	348.5192	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	94.2611	16.4900	15.5437	(249)
Energy for lighting	113.2174	16.4900	18.6696	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-327.4960	16.4900	-54.0041	
PV Unit electricity exported	-158.2802	5.5900	-8.8479	
Total			-62.8519	(252)
Total energy cost			322.5743	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2763	(257)
SAP value		79.3119	
SAP rating (Section 12)		79	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	16.3362	0.1614	2.6372	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2113.5187	0.1412	298.5203	(264)
Space and water heating			301.1575	(265)
Pumps, fans and electric keep-hot	94.2611	0.1387	13.0752	(267)
Energy for lighting	113.2174	0.1443	16.3408	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-327.4960	0.1322	-43.2846	
PV Unit electricity exported	-158.2802	0.1234	-19.5382	
Total			-62.8227	(269)
Total CO2, kg/year			267.7507	(272)
CO2 emissions per m2			5.8200	(273)
EI value			96.0569	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		45.9900	(1b)	x 2.4000	(2b) =	110.3760	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.9900						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		110.3760	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.1800	1.2357	8.8726			(27)
External Wall 1	16.0600	7.1800	8.8800	0.1400	1.2432	14.0000	124.3200	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	10.1158			(33)
Party Wall 1			23.2200	0.0000	0.0000	20.0000	464.4000	(32)
Wall to corridor			39.2800	0.0000	0.0000	20.0000	785.6000	(32)
Party Floor 1			45.9900			80.0000	3679.2000	(32d)
Party Ceiling 1			45.9900			80.0000	3679.2000	(32b)
Internal Wall 1			66.6300			9.0000	599.6700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 9332.3900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	202.9222 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.0900	0.0500	0.1545
E4 Jamb	18.5600	0.0500	0.9280
E7 Party floor between dwellings (in blocks of flats)	11.9000	0.0700	0.8330
E18 Party wall between dwellings	2.7000	0.0600	0.1620
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	46.3000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	2.0775 (36)
Point Thermal bridges	(36a) = 0.0000
Total fabric heat loss	(33) + (36) + (36a) = 12.1933 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	10.6040	10.6040	10.3922	9.7571	9.6512	9.2278	9.0161	9.0161	9.4395	9.9688	10.1805	10.0747	(38)
Heat transfer coeff	22.7973	22.7973	22.5856	21.9504	21.8446	21.4211	21.2094	21.2094	21.6329	22.1621	22.3739	22.2680	(39)
Average = Sum(39)m / 12 =												22.0210	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4957	0.4957	0.4911	0.4773	0.4750	0.4658	0.4612	0.4612	0.4704	0.4819	0.4865	0.4842	(40)
HLP (average)												0.4788	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.5731 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	69.5673	68.5219	66.9984	64.0836	61.9325	59.5337	58.1702	59.6821	61.3394	63.9151	66.8925	69.3008	(42a)
Hot water usage for baths	21.8805	21.5555	21.0979	20.2542	19.6224	18.9219	18.5435	18.9979	19.4926	20.2422	21.1034	21.8065	(42b)
Hot water usage for other uses	30.7397	29.6219	28.5041	27.3863	26.2684	25.1506	25.1506	26.2684	27.3863	28.5041	29.6219	30.7397	(42c)
Average daily hot water use (litres/day)												112.3706	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	122.1875	119.6993	116.6004	111.7240	107.8234	103.6062	101.8643	104.9484	108.2183	112.6614	117.6177	121.8470	(44)
Energy conte	193.5151	170.4502	179.2105	152.9446	145.1510	127.3959	123.1960	129.9480	133.4440	152.8804	167.5680	190.7830	(45)
Energy content (annual)										Total = Sum(45)m =		1866.4867	
Distribution loss (46)m = 0.15 x (45)m	29.0273	25.5675	26.8816	22.9417	21.7726	19.1094	18.4794	19.4922	20.0166	22.9321	25.1352	28.6174	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638	(64)
									Total per year (kWh/year) = Sum(64)m =			2113.5187	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	81.1284	71.8350	76.3721	67.0973	65.0473	58.6023	57.7473	59.9924	60.6133	67.6174	71.9596	80.2200	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	94.3834	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.0271	14.2351	11.5768	8.7644	6.5515	5.5310	5.9765	7.7684	10.4268	13.2392	15.4521	16.4725	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	204.2328	206.3521	201.0115	189.6421	175.2902	161.8015	152.7902	150.6709	156.0115	167.3809	181.7328	195.2215	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	46.0114	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	-62.9223	(71)
Water heating gains (Table 5)	109.0436	106.8973	102.6507	93.1907	87.4292	81.3921	77.6173	80.6349	84.1852	90.8836	99.9438	107.8225	(72)
Total internal gains	406.7760	404.9571	392.7115	369.0697	346.7435	326.1972	313.8566	316.5468	328.0960	348.9762	374.6012	396.9891	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.1800	33.4622	0.6300	0.8270	0.7700	86.7478	(79)

Solar gains	86.7478	157.7089	225.5139	293.9220	325.8839	314.4382	306.9161	273.5144	241.9971	173.2574	106.7816	75.9203	(83)
Total gains	493.5238	562.6659	618.2254	662.9917	672.6273	640.6354	620.7726	590.0612	570.0931	522.2336	481.3828	472.9094	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	113.7123	113.7123	114.7782	118.0993	118.6716	121.0174	122.2254	122.2254	119.8330	116.9711	115.8643	116.4151	
alpha	8.5808	8.5808	8.6519	8.8733	8.9114	9.0678	9.1484	9.1484	8.9889	8.7981	8.7243	8.7610	
util living area	0.7654	0.6688	0.5609	0.4336	0.3345	0.2608	0.2084	0.2229	0.3112	0.4792	0.6625	0.7856	(86)
MIT	20.9615	20.9859	20.9966	20.9997	21.0000	21.0000	21.0000	21.0000	21.0000	20.9994	20.9896	20.9563	(87)
Th 2	20.5248	20.5248	20.5290	20.5417	20.5438	20.5523	20.5565	20.5565	20.5481	20.5375	20.5332	20.5353	(88)
util rest of house	0.7479	0.6511	0.5441	0.4184	0.3197	0.2458	0.1933	0.2069	0.2940	0.4596	0.6424	0.7688	(89)
MIT 2	20.4843	20.5104	20.5257	20.5414	20.5438	20.5523	20.5565	20.5565	20.5480	20.5369	20.5229	20.4889	(90)
Living area fraction									fLA = Living area / (4) =			0.5849	(91)
MIT	20.7634	20.7885	20.8012	20.8095	20.8106	20.8142	20.8159	20.8159	20.8124	20.8074	20.7959	20.7623	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7634	20.7885	20.8012	20.8095	20.8106	20.8142	20.8159	20.8159	20.8124	20.8074	20.7959	20.7623	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7568	0.6609	0.5538	0.4273	0.3283	0.2546	0.2021	0.2162	0.3040	0.4710	0.6537	0.7771	(94)
Useful gains	373.4742	371.8934	342.3822	283.2820	220.8548	163.1035	125.4734	127.5943	173.3282	245.9893	314.6931	367.4971	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	384.4399	375.8937	343.3267	283.3681	220.8620	163.1040	125.4734	127.5943	173.3309	246.1635	317.6160	379.9425	(97)
Space heating kWh	8.1585	2.6882	0.7027	0.0619	0.0054	0.0000	0.0000	0.0000	0.0000	0.1295	2.1045	9.2594	(98a)
Space heating requirement - total per year (kWh/year)												23.1102	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	8.1585	2.6882	0.7027	0.0619	0.0054	0.0000	0.0000	0.0000	0.0000	0.1295	2.1045	9.2594	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												23.1102	
Space heating per m2											(98c) / (4) =	0.5025	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	8.1585	2.6882	0.7027	0.0619	0.0054	0.0000	0.0000	0.0000	0.0000	0.1295	2.1045	9.2594	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													

	8.1585	2.6882	0.7027	0.0619	0.0054	0.0000	0.0000	0.0000	0.0000	0.1295	2.1045	9.2594 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	214.4959	189.4006	200.1913	173.2486	166.1318	147.6999	144.1768	150.9288	153.7480	173.8612	187.8720	211.7638 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	8.0057	7.2310	8.0057	7.7475	8.0057	7.7475	8.0057	8.0057	7.7475	8.0057	7.7475	8.0057 (231)
Lighting	14.0284	11.2541	10.1331	7.4239	5.7345	4.6851	5.2312	6.7997	8.8321	11.5882	13.0888	14.4183 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-9.8713	-16.7438	-28.5078	-37.7931	-44.3587	-41.9198	-41.6208	-36.6000	-29.5382	-20.6038	-11.7373	-8.4828 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-1.7837	-4.5666	-10.7642	-19.3138	-26.7544	-26.4809	-26.5266	-20.5284	-13.8216	-6.8393	-2.5795	-1.4155 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	23.1102 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2113.5187 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	94.2611 (230a)
Total electricity for the above, kWh/year	94.2611 (231)
Electricity for lighting (calculated in Appendix L)	113.2174 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-489.1519 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1854.9555 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	23.1102	25.1600	5.8145	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2113.5187	25.1600	531.7613	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	94.2611	25.1600	23.7161	(249)
Energy for lighting	113.2174	25.1600	28.4855	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-327.7774	25.1600	-82.4688	
PV Unit electricity exported	-161.3745	5.8100	-9.3759	
Total			-91.8446	(252)
Total energy cost			497.9328	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	23.1102	0.1610	3.7217	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2113.5187	0.1412	298.5203	(264)
Space and water heating			302.2420	(265)
Pumps, fans and electric keep-hot	94.2611	0.1387	13.0752	(267)
Energy for lighting	113.2174	0.1443	16.3408	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-327.7774	0.1319	-43.2198	
PV Unit electricity exported	-161.3745	0.1230	-19.8429	
Total			-63.0626	(269)
Total CO2, kg/year			268.5953	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	23.1102	1.5959	36.8826	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2113.5187	1.5223	3217.3749	(278)
Space and water heating			3254.2575	(279)

Pumps, fans and electric keep-hot	94.2611	1.5128	142.5982 (281)
Energy for lighting	113.2174	1.5338	173.6566 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-327.7774	1.4872	-487.4614
PV Unit electricity exported	-161.3745	0.4513	-72.8228
Total			-560.2841 (283)
Total Primary energy kWh/year			3010.2282 (286)

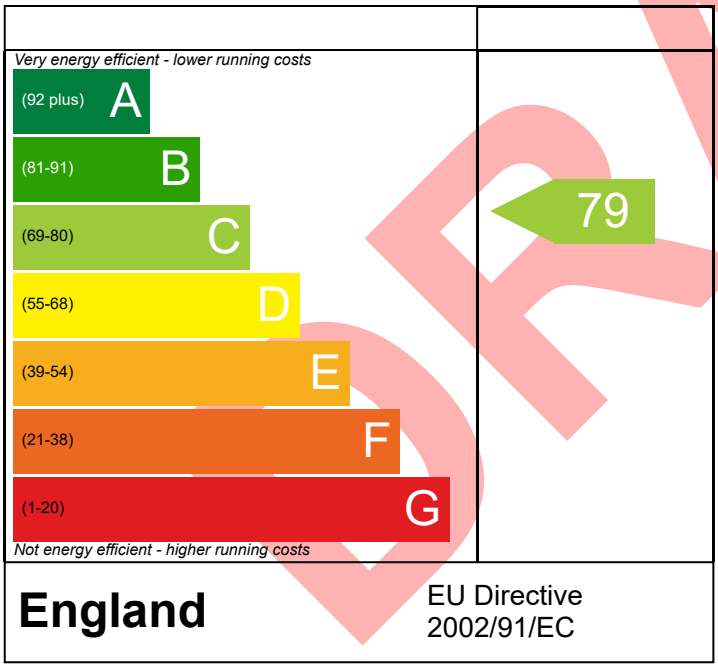
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	45.99 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

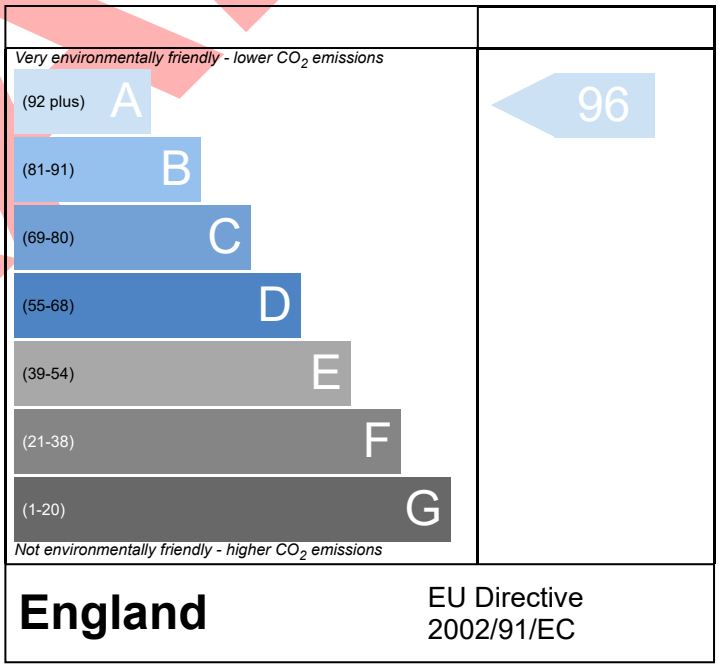
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:29

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	71 m^2
Site Reference	Unit 416 L02_Copy	Plot Reference	Unit 416 L02_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*9.51 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	4.43 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*51.39 kWh$_{PE}$/m^2*	
Dwelling primary energy	50.5 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*14.0 kWh/m^2*	
Dwelling fabric energy efficiency	12.9 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	11	0.14 **(!)**
Party wall: Party Wall (1)	52.62	0 **(!)**
Party wall: Party Wall (2)	15.55	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	11.81	South West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.92 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 416 L02_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 416 L02_Copy	**Prop Type Ref**	Unit 416 L02
Property			

SAP Rating	81 B	**DER**	4.43	**TER**	9.51
Environmental	96 A	**% DER < TER**			53.42
CO_2 Emissions (t/year)	0.31	**DFEE**	12.95	**TFEE**	14.02
Compliance Check	See BREL	**% DFEE < TFEE**			7.68
% DPER < TPER	1.73	**DPER**	50.50	**TPER**	51.39

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			136.8900			9.0000	1232.0100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 14106.2100	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.7350	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545

E4 Jamb	13.9200	0.0500	0.6960	
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.8660 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.2026	16.0392	15.8758	15.0589	14.8955	14.0786	14.0786	13.9153	14.4054	14.8955	15.2223	15.5490	(38)
Heat transfer coeff	34.2027	34.0393	33.8759	33.0590	32.8956	32.0787	32.0787	31.9154	32.4055	32.8956	33.2224	33.5491	(39)

Average = Sum(39)m / 12 = 33.0182

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4819	0.4796	0.4773	0.4658	0.4634	0.4519	0.4519	0.4496	0.4565	0.4634	0.4681	0.4727	(40)
HLP (average)												0.4652	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2697 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day) 138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)

Energy content (annual) Total = Sum(45)m = 2297.5146

Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)

Total per year (kWh/year) = Sum(64)m = 2544.5466 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	11.8100	36.7938	0.6300	0.8270	0.7700	156.8932	(79)

Solar gains	156.8932	267.2472	365.6593	453.0696	507.4757	503.8059	485.7227	445.1333	395.9317	295.3651	187.9219	134.2679	(83)
Total gains	703.2397	811.4507	893.0014	948.1177	971.2994	939.0493	903.8213	866.4472	833.2498	761.5780	689.4197	666.6128	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.5640	115.1138	115.6690	118.5272	119.1159	122.1492	122.1492	122.7745	120.9175	119.1159	117.9443	116.7956	
alpha	8.6376	8.6743	8.7113	8.9018	8.9411	9.1433	9.1433	9.1850	9.0612	8.9411	8.8630	8.7864	
util living area													
	0.7830	0.6679	0.5487	0.4218	0.3150	0.2186	0.1562	0.1694	0.2683	0.4490	0.6634	0.8084	(86)
MIT	20.9566	20.9872	20.9974	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9997	20.9906	20.9478	(87)
Th 2	20.5375	20.5396	20.5417	20.5523	20.5544	20.5651	20.5651	20.5672	20.5608	20.5544	20.5502	20.5460	(88)
util rest of house													
	0.7656	0.6501	0.5316	0.4062	0.2999	0.2038	0.1407	0.1535	0.2513	0.4298	0.6432	0.7918	(89)
MIT 2	20.4917	20.5266	20.5392	20.5521	20.5544	20.5651	20.5651	20.5672	20.5608	20.5542	20.5409	20.4903	(90)
Living area fraction										fLA = Living area / (4) =		0.4060	(91)
MIT	20.6805	20.7136	20.7253	20.7339	20.7353	20.7417	20.7417	20.7429	20.7391	20.7351	20.7235	20.6760	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6805	20.7136	20.7253	20.7339	20.7353	20.7417	20.7417	20.7429	20.7391	20.7351	20.7235	20.6760	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7711	0.6569	0.5385	0.4125	0.3060	0.2098	0.1470	0.1600	0.2582	0.4376	0.6510	0.7967	(94)
Useful gains	542.2498	533.0331	480.8626	391.1295	297.2181	197.0170	132.8596	138.6063	215.1439	333.2833	448.8144	531.0779	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	560.2549	538.2843	481.8939	391.2164	297.2233	197.0171	132.8596	138.6064	215.1447	333.3996	452.6050	552.7564	(97)
Space heating kWh													
	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(98a)
Space heating requirement - total per year (kWh/year)												36.7029	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												36.7029	
Space heating per m2											(98c) / (4) =	0.5171	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)
Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.7495	-26.5603	-43.1928	-54.4883	-64.0200	-61.6099	-60.6290	-54.7463	-44.7493	-32.6607	-19.3354	-14.1254	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.5280	-8.2015	-18.0659	-29.9413	-41.8277	-42.9674	-42.3587	-34.2994	-23.4325	-12.3753	-4.9084	-2.7087	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	36.7029	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2544.5466	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	154.2094	(230a)
Total electricity for the above, kWh/year	154.2094	(231)
Electricity for lighting (calculated in Appendix L)	163.7369	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-757.4814	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2141.7144	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	36.7029	16.4900	6.0523	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	16.4900	419.5957	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	16.4900	25.4291	(249)
Energy for lighting	163.7369	16.4900	27.0002	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-492.8668	16.4900	-81.2737	
PV Unit electricity exported	-264.6146	5.5900	-14.7920	
Total			-96.0657	(252)
Total energy cost			382.0117	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1858	(257)
SAP value		80.7789	
SAP rating (Section 12)		81	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	36.7029	0.1615	5.9279	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			365.4724	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-492.8668	0.1323	-65.2087	
PV Unit electricity exported	-264.6146	0.1235	-32.6780	
Total			-97.8867	(269)
Total CO2, kg/year			312.6088	(272)
CO2 emissions per m2			4.4000	(273)
EI value			96.3882	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			136.8900			9.0000	1232.0100	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14106.2100 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 198.7350 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.8660 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3659	16.3659	16.0392	15.0589	14.8955	14.2420	13.9153	13.9153	14.5688	15.3857	15.7124	15.5490	(38)
Heat transfer coeff	34.3660	34.3660	34.0393	33.0590	32.8956	32.2421	31.9154	31.9154	32.5689	33.3858	33.7125	33.5491	(39)

Average = Sum(39)m / 12 = 33.1679

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4842	0.4842	0.4796	0.4658	0.4634	0.4542	0.4496	0.4496	0.4588	0.4704	0.4750	0.4727	(40)
HLP (average)												0.4673	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2697 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day) 138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:

Store volume 143.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)

Temperature factor from Table 2b 0.6000 (49)

Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
										Total per year (kWh/year) = Sum(64)m =		2544.5466	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)													
	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains													
	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	11.8100	33.4622	0.6300	0.8270	0.7700	142.6869	(79)

Solar gains	142.6869	259.4069	370.9357	483.4567	536.0291	517.2027	504.8299	449.8893	398.0481	284.9819	175.6394	124.8772	(83)
Total gains	689.0334	803.6104	898.2779	978.5047	999.8527	952.4462	922.9286	871.2033	835.3662	751.1948	677.1372	657.2222	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.0193	114.0193	115.1138	118.5272	119.1159	121.5302	122.7745	122.7745	120.3109	117.3671	116.2296	116.7956	
alpha	8.6013	8.6013	8.6743	8.9018	8.9411	9.1020	9.1850	9.1850	9.0207	8.8245	8.7486	8.7864	
util living area													
	0.8121	0.7024	0.5813	0.4424	0.3389	0.2640	0.2109	0.2271	0.3197	0.5016	0.7054	0.8339	(86)
MIT	20.9408	20.9801	20.9957	20.9996	21.0000	21.0000	21.0000	21.0000	21.0000	20.9991	20.9836	20.9316	(87)
Th 2	20.5354	20.5354	20.5396	20.5523	20.5544	20.5630	20.5672	20.5672	20.5587	20.5481	20.5438	20.5460	(88)
util rest of house													
	0.7957	0.6848	0.5643	0.4273	0.3242	0.2492	0.1960	0.2113	0.3025	0.4817	0.6853	0.8185	(89)
MIT 2	20.4720	20.5147	20.5353	20.5520	20.5544	20.5630	20.5672	20.5672	20.5587	20.5473	20.5274	20.4721	(90)
Living area fraction										fLA = Living area / (4) =		0.4060	(91)
MIT	20.6623	20.7037	20.7222	20.7337	20.7353	20.7404	20.7429	20.7429	20.7379	20.7307	20.7126	20.6587	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6623	20.7037	20.7222	20.7337	20.7353	20.7404	20.7429	20.7429	20.7379	20.7307	20.7126	20.6587	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8002	0.6912	0.5711	0.4334	0.3302	0.2553	0.2021	0.2177	0.3095	0.4898	0.6928	0.8224	(94)
Useful gains	551.3951	555.4826	512.9858	424.1297	330.1075	243.1179	186.4793	189.6708	258.5229	367.9207	469.1053	540.4930	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	576.0546	563.7301	514.7494	424.2710	330.1185	243.1186	186.4794	189.6709	258.5275	368.2690	475.7715	568.9488	(97)
Space heating kWh													
	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711	(98a)
Space heating requirement - total per year (kWh/year)												51.5410	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												51.5410	
Space heating per m2											(98c) / (4) =	0.7261	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)

Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-15.1816	-25.5601	-43.1889	-56.7799	-66.2625	-62.5005	-62.0252	-54.7629	-44.4553	-31.2938	-17.9805	-13.0606 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.9923	-7.6695	-18.0487	-32.2682	-44.6258	-44.1582	-44.2385	-34.3187	-23.1566	-11.4989	-4.3440	-2.3741 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	51.5410 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2544.5466 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	154.2094 (230a)
Total electricity for the above, kWh/year	154.2094 (231)
Electricity for lighting (calculated in Appendix L)	163.7369 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-762.7453 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2151.2886 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	51.5410	25.1600	12.9677	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	25.1600	640.2079	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	25.1600	38.7991	(249)
Energy for lighting	163.7369	25.1600	41.1962	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.0518	25.1600	-124.0518	
PV Unit electricity exported	-269.6935	5.8100	-15.6692	
Total			-139.7210	(252)
Total energy cost			593.4499	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	51.5410	0.1611	8.3045	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			367.8491	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.0518	0.1320	-65.0800	
PV Unit electricity exported	-269.6935	0.1230	-33.1742	
Total			-98.2543	(269)
Total CO2, kg/year			314.6179	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	51.5410	1.5962	82.2716	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	1.5225	3874.0629	(278)
Space and water heating			3956.3345	(279)
Pumps, fans and electric keep-hot	154.2094	1.5128	233.2880	(281)
Energy for lighting	163.7369	1.5338	251.1452	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.0518	1.4877	-733.5071	
PV Unit electricity exported	-269.6935	0.4514	-121.7494	
Total			-855.2565	(283)
Total Primary energy kWh/year			3585.5112	(286)

SAP 10 EPC IMPROVEMENTS

Unit 416 L02_Copy

Current energy efficiency rating: B 81
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: B 81
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£733	£733	£0
Space heating	£52	£52	£0
Water heating	£640	£640	£0
Lighting	£41	£41	£0
Generated (PV)	-£140	-£140	£0
Total cost of fuels	£593	£593	£0
Total cost of uses	£593	£593	£0
Delivered energy	30 kWh/m²	30 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	4 kg/m²	4 kg/m²	0 kg/m²
Primary energy	51 kWh/m²	51 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			136.8900			9.0000	1232.0100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14106.2100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		198.7350 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.8660 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.2026	16.0392	15.8758	15.0589	14.8955	14.0786	14.0786	13.9153	14.4054	14.8955	15.2223	15.5490	(38)
Heat transfer coeff	34.2027	34.0393	33.8759	33.0590	32.8956	32.0787	32.0787	31.9154	32.4055	32.8956	33.2224	33.5491	(39)
Average = Sum(39)m / 12 =												33.0182	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4819	0.4796	0.4773	0.4658	0.4634	0.4519	0.4519	0.4496	0.4565	0.4634	0.4681	0.4727	(40)
HLP (average)												0.4652	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.2697 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)

Hot water usage for baths

26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)

Hot water usage for other uses

37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day)		138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
									Total per year (kWh/year) = Sum(64)m =		2544.5466	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest			11.8100	36.7938	0.6300	0.8270	0.7700	156.8932	(79)
Solar gains	156.8932	267.2472	365.6593	453.0696	507.4757	503.8059	485.7227	445.1333	395.9317	295.3651	187.9219	134.2679	(83)
Total gains	703.2397	811.4507	893.0014	948.1177	971.2994	939.0493	903.8213	866.4472	833.2498	761.5780	689.4197	666.6128	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.5640	115.1138	115.6690	118.5272	119.1159	122.1492	122.1492	122.7745	120.9175	119.1159	117.9443	116.7956	
alpha	8.6376	8.6743	8.7113	8.9018	8.9411	9.1433	9.1433	9.1850	9.0612	8.9411	8.8630	8.7864	
util living area	0.7830	0.6679	0.5487	0.4218	0.3150	0.2186	0.1562	0.1694	0.2683	0.4490	0.6634	0.8084	(86)
MIT	20.9566	20.9872	20.9974	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9997	20.9906	20.9478	(87)
Th 2	20.5375	20.5396	20.5417	20.5523	20.5544	20.5651	20.5651	20.5672	20.5608	20.5544	20.5502	20.5460	(88)
util rest of house	0.7656	0.6501	0.5316	0.4062	0.2999	0.2038	0.1407	0.1535	0.2513	0.4298	0.6432	0.7918	(89)
MIT 2	20.4917	20.5266	20.5392	20.5521	20.5544	20.5651	20.5651	20.5672	20.5608	20.5542	20.5409	20.4903	(90)
Living area fraction									fLA = Living area / (4) =			0.4060	(91)
MIT	20.6805	20.7136	20.7253	20.7339	20.7353	20.7417	20.7417	20.7429	20.7391	20.7351	20.7235	20.6760	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6805	20.7136	20.7253	20.7339	20.7353	20.7417	20.7417	20.7429	20.7391	20.7351	20.7235	20.6760	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7711	0.6569	0.5385	0.4125	0.3060	0.2098	0.1470	0.1600	0.2582	0.4376	0.6510	0.7967	(94)
Useful gains	542.2498	533.0331	480.8626	391.1295	297.2181	197.0170	132.8596	138.6063	215.1439	333.2833	448.8144	531.0779	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	560.2549	538.2843	481.8939	391.2164	297.2233	197.0171	132.8596	138.6064	215.1447	333.3996	452.6050	552.7564	(97)
Space heating kWh	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(98a)
Space heating requirement - total per year (kWh/year)												36.7029	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												36.7029	
Space heating per m2										(98c) / (4) =		0.5171	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	13.3959	3.5288	0.7673	0.0626	0.0039	0.0000	0.0000	0.0000	0.0000	0.0865	2.7292	16.1288	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)
Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.7495	-26.5603	-43.1928	-54.4883	-64.0200	-61.6099	-60.6290	-54.7463	-44.7493	-32.6607	-19.3354	-14.1254	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.5280	-8.2015	-18.0659	-29.9413	-41.8277	-42.9674	-42.3587	-34.2994	-23.4325	-12.3753	-4.9084	-2.7087	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												36.7029	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2544.5466	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	154.2094	(230a)
Total electricity for the above, kWh/year	154.2094	(231)
Electricity for lighting (calculated in Appendix L)	163.7369	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-757.4814	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2141.7144	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	36.7029	16.4900	6.0523	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	16.4900	419.5957	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	16.4900	25.4291	(249)
Energy for lighting	163.7369	16.4900	27.0002	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-492.8668	16.4900	-81.2737	
PV Unit electricity exported	-264.6146	5.5900	-14.7920	
Total			-96.0657	(252)
Total energy cost			382.0117	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.1858	(257)
SAP value	80.7789	
SAP rating (Section 12)	81	(258)
SAP band	B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	36.7029	0.1615	5.9279	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			365.4724	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-492.8668	0.1323	-65.2087	
PV Unit electricity exported	-264.6146	0.1235	-32.6780	
Total			-97.8867	(269)
Total CO2, kg/year			312.6088	(272)
CO2 emissions per m2			4.4000	(273)
EI value			96.3882	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 = 0.0000	(6a)
Number of open flues	0 * 20 = 0.0000	(6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			136.8900			9.0000	1232.0100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 14106.2100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.7350 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	1.8660 (36)
Point Thermal bridges (36a) =	0.0000
Total fabric heat loss (33) + (36) + (36a) =	18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3659	16.3659	16.0392	15.0589	14.8955	14.2420	13.9153	13.9153	14.5688	15.3857	15.7124	15.5490	(38)
Heat transfer coeff	34.3660	34.3660	34.0393	33.0590	32.8956	32.2421	31.9154	31.9154	32.5689	33.3858	33.7125	33.5491	(39)
Average = Sum(39)m / 12 =												33.1679	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4842	0.4842	0.4796	0.4658	0.4634	0.4542	0.4496	0.4496	0.4588	0.4704	0.4750	0.4727	(40)
HLP (average)												0.4673	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2697 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)
Average daily hot water use (litres/day)												138.3203	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
									Total per year (kWh/year) = Sum(64)m =			2544.5466	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	11.8100	33.4622	0.6300	0.8270	0.7700	142.6869	(79)

Solar gains	142.6869	259.4069	370.9357	483.4567	536.0291	517.2027	504.8299	449.8893	398.0481	284.9819	175.6394	124.8772	(83)
Total gains	689.0334	803.6104	898.2779	978.5047	999.8527	952.4462	922.9286	871.2033	835.3662	751.1948	677.1372	657.2222	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.0193	114.0193	115.1138	118.5272	119.1159	121.5302	122.7745	122.7745	120.3109	117.3671	116.2296	116.7956	
alpha	8.6013	8.6013	8.6743	8.9018	8.9411	9.1020	9.1850	9.1850	9.0207	8.8245	8.7486	8.7864	
util living area	0.8121	0.7024	0.5813	0.4424	0.3389	0.2640	0.2109	0.2271	0.3197	0.5016	0.7054	0.8339	(86)
MIT	20.9408	20.9801	20.9957	20.9996	21.0000	21.0000	21.0000	21.0000	21.0000	20.9991	20.9836	20.9316	(87)
Th 2	20.5354	20.5354	20.5396	20.5523	20.5544	20.5630	20.5672	20.5672	20.5587	20.5481	20.5438	20.5460	(88)
util rest of house	0.7957	0.6848	0.5643	0.4273	0.3242	0.2492	0.1960	0.2113	0.3025	0.4817	0.6853	0.8185	(89)
MIT 2	20.4720	20.5147	20.5353	20.5520	20.5544	20.5630	20.5672	20.5672	20.5587	20.5473	20.5274	20.4721	(90)
Living area fraction									fLA = Living area / (4) =			0.4060	(91)
MIT	20.6623	20.7037	20.7222	20.7337	20.7353	20.7404	20.7429	20.7429	20.7379	20.7307	20.7126	20.6587	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6623	20.7037	20.7222	20.7337	20.7353	20.7404	20.7429	20.7429	20.7379	20.7307	20.7126	20.6587	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8002	0.6912	0.5711	0.4334	0.3302	0.2553	0.2021	0.2177	0.3095	0.4898	0.6928	0.8224	(94)
Useful gains	551.3951	555.4826	512.9858	424.1297	330.1075	243.1179	186.4793	189.6708	258.5229	367.9207	469.1053	540.4930	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	576.0546	563.7301	514.7494	424.2710	330.1185	243.1186	186.4794	189.6709	258.5275	368.2690	475.7715	568.9488	(97)
Space heating kWh	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711	(98a)
Space heating requirement - total per year (kWh/year)												51.5410	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												51.5410	
Space heating per m2											(98c) / (4) =	0.7261	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													

	18.3466	5.5423	1.3122	0.1018	0.0082	0.0000	0.0000	0.0000	0.0000	0.2591	4.7996	21.1711 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972 (231)
Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-15.1816	-25.5601	-43.1889	-56.7799	-66.2625	-62.5005	-62.0252	-54.7629	-44.4553	-31.2938	-17.9805	-13.0606 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.9923	-7.6695	-18.0487	-32.2682	-44.6258	-44.1582	-44.2385	-34.3187	-23.1566	-11.4989	-4.3440	-2.3741 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	51.5410 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2544.5466 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	154.2094 (230a)
Total electricity for the above, kWh/year	154.2094 (231)
Electricity for lighting (calculated in Appendix L)	163.7369 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-762.7453 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2151.2886 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	51.5410	25.1600	12.9677	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	25.1600	640.2079	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	25.1600	38.7991	(249)
Energy for lighting	163.7369	25.1600	41.1962	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.0518	25.1600	-124.0518	
PV Unit electricity exported	-269.6935	5.8100	-15.6692	
Total			-139.7210	(252)
Total energy cost			593.4499	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	51.5410	0.1611	8.3045	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			367.8491	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.0518	0.1320	-65.0800	
PV Unit electricity exported	-269.6935	0.1230	-33.1742	
Total			-98.2543	(269)
Total CO2, kg/year			314.6179	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	51.5410	1.5962	82.2716	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	1.5225	3874.0629	(278)
Space and water heating			3956.3345	(279)

Pumps, fans and electric keep-hot	154.2094	1.5128	233.2880	(281)
Energy for lighting	163.7369	1.5338	251.1452	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.0518	1.4877	-733.5071	
PV Unit electricity exported	-269.6935	0.4514	-121.7494	
Total			-855.2565	(283)
Total Primary energy kWh/year			3585.5112	(286)

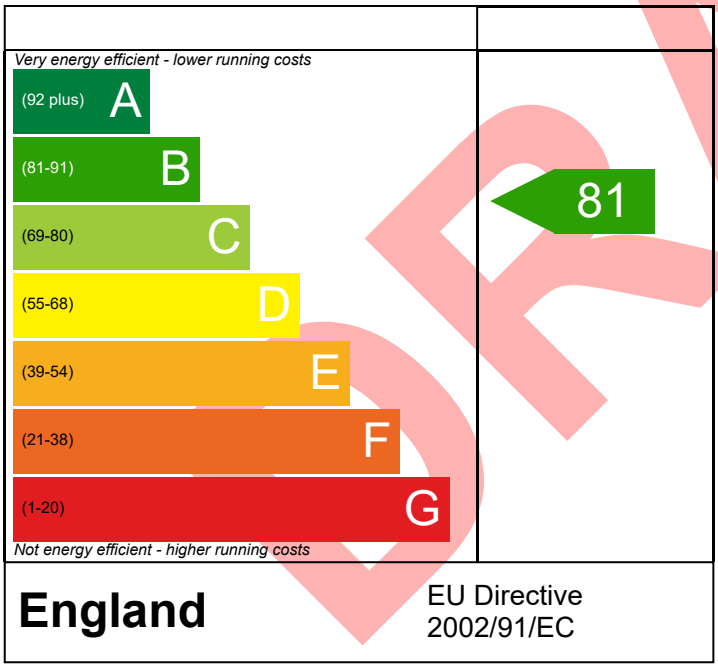
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	70.98 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

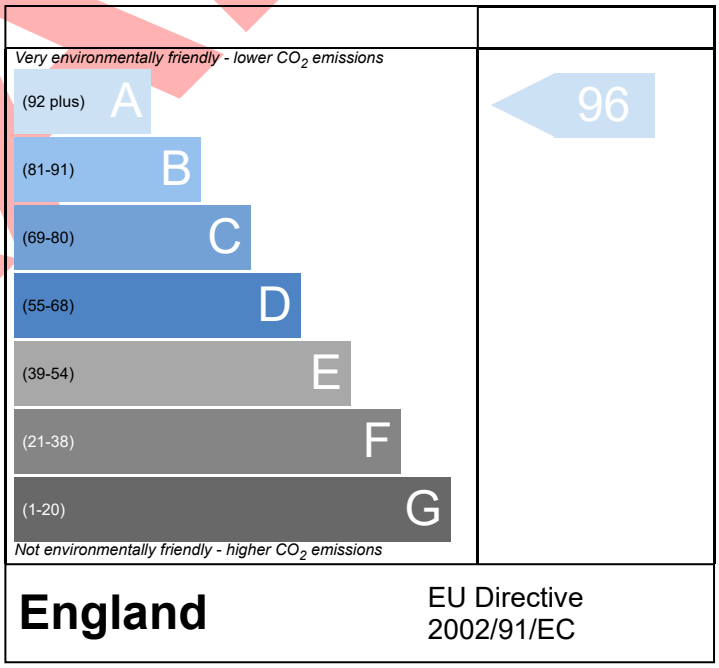
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:30

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	66 m^2
Site Reference	Unit 417 L02_Copy	Plot Reference	Unit 417 L02_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*10.63 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	5.05 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*57.39 kWh$_{PE}$/m^2*	
Dwelling primary energy	56.68 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*19.0 kWh/m^2*	
Dwelling fabric energy efficiency	18.9 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	24.21	0.14 **(!)**
Party wall: Party Wall (1)	55.93	0 **(!)**
Party wall: Party Wall (2)	3.85	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	7.88	South West	0.83	1.3
SE, Opening Type 1	11.81	South East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.86 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 417 L02_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 417 L02_Copy	**Prop Type Ref**	Unit 417 L02
Property			

SAP Rating	79 C	**DER**	5.05	**TER**	10.63
Environmental	96 A	**% DER < TER**			52.49
CO_2 Emissions (t/year)	0.34	**DFEE**	18.93	**TFEE**	19.00
Compliance Check	See BREL	**% DFEE < TFEE**			0.33
% DPER < TPER	1.24	**DPER**	56.68	**TPER**	57.39

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.5000 (1b)	x	2.4000 (2b)	=	159.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.6000	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	43.9000	19.6900	24.2100	0.1400	3.3894	14.0000	338.9400	(29a)
Total net area of external elements Aum(A, m2)			43.9000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.7211			(33)
Party Wall 1			55.9300	0.0000	0.0000	20.0000	1118.6000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.5000			80.0000	5320.0000	(32d)
Party Ceiling 1			66.5000			80.0000	5320.0000	(32b)
Internal Wall 1			140.2900			9.0000	1262.6100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13437.1500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.0624 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240

E4 Jamb	23.2000	0.0500	1.1600	
E7 Party floor between dwellings (in blocks of flats)	16.1600	0.0700	1.1312	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	22.1400	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.0392 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 30.7603 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.9354	15.7675	15.5996	14.7602	14.5923	13.7529	13.7529	13.5851	14.0887	14.5923	14.9281	15.2638	(38)
Heat transfer coeff	46.6957	46.5278	46.3600	45.5206	45.3527	44.5133	44.5133	44.3454	44.8490	45.3527	45.6884	46.0242	(39)

Average = Sum(39)m / 12 = 45.4786

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7022	0.6997	0.6971	0.6845	0.6820	0.6694	0.6694	0.6668	0.6744	0.6820	0.6870	0.6921	(40)
HLP (average)												0.6839	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1583 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	83.0588	81.8106	79.9917	76.5116	73.9433	71.0793	69.4513	71.2564	73.2352	76.3103	79.8652	82.7406	(42a)
Hot water usage for baths	26.1000	25.7123	25.1665	24.1600	23.4064	22.5708	22.1194	22.6614	23.2516	24.1458	25.1729	26.0117	(42b)
Hot water usage for other uses	36.7327	35.3969	34.0612	32.7255	31.3897	30.0540	30.0540	31.3897	32.7255	34.0612	35.3969	36.7327	(42c)

Average daily hot water use (litres/day) 134.1695 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.8914	142.9198	139.2194	133.3971	128.7395	123.7040	121.6247	125.3076	129.2122	134.5173	140.4351	145.4849	(44)
Energy conte	231.0563	203.5159	213.9750	182.6139	173.3081	152.1085	147.0945	155.1570	159.3316	182.5387	200.0755	227.7943	(45)

Energy content (annual) Total = Sum(45)m = 2228.5693

Distribution loss (46)m = 0.15 x (45)m	34.6584	30.5274	32.0962	27.3921	25.9962	22.8163	22.0642	23.2735	23.8997	27.3808	30.0113	34.1691	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)

Total per year (kWh/year) = Sum(64)m = 2475.6013 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	93.6109	82.8294	87.9313	76.9623	74.4096	66.8193	65.6936	68.3743	69.2210	77.4788	82.7683	92.5262	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7552	19.3227	15.7143	11.8967	8.8930	7.5078	8.1125	10.5449	14.1533	17.9709	20.9747	22.3598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	282.0814	285.0085	277.6323	261.9291	242.1067	223.4764	211.0302	208.1031	215.4793	231.1825	251.0049	269.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	(71)
Water heating gains (Table 5)	125.8211	123.2580	118.1873	106.8921	100.0129	92.8046	88.2978	91.9010	96.1402	104.1381	114.9560	124.3632	(72)
Total internal gains	522.9304	520.8621	504.8066	473.9908	444.2853	417.0615	400.7133	403.8217	419.0457	446.5643	480.2084	509.6310	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	11.8100	36.7938	0.6300	0.8270	0.7700	156.8932	(77)
Southwest	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(79)

Solar gains	261.5773	445.5629	609.6386	755.3718	846.0793	839.9609	809.8120	742.1401	660.1097	492.4419	313.3093	223.8557	(83)
Total gains	784.5077	966.4250	1114.4452	1229.3625	1290.3646	1257.0225	1210.5252	1145.9618	1079.1553	939.0062	793.5177	733.4867	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	79.9333	80.2217	80.5122	81.9968	82.3004	83.8523	83.8523	84.1698	83.2246	82.3004	81.6955	81.0996	
alpha	6.3289	6.3481	6.3675	6.4665	6.4867	6.5902	6.5902	6.6113	6.5483	6.4867	6.4464	6.4066	
util living area	0.8610	0.7342	0.5934	0.4467	0.3267	0.2266	0.1618	0.1780	0.2867	0.4994	0.7534	0.8867	(86)
MIT	20.7806	20.9169	20.9770	20.9964	20.9996	21.0000	21.0000	21.0000	20.9999	20.9943	20.9214	20.7412	(87)
Th 2	20.3389	20.3411	20.3434	20.3545	20.3568	20.3680	20.3680	20.3702	20.3635	20.3568	20.3523	20.3478	(88)
util rest of house	0.8427	0.7107	0.5685	0.4232	0.3042	0.2042	0.1386	0.1536	0.2603	0.4693	0.7265	0.8706	(89)
MIT 2	20.1020	20.2557	20.3211	20.3513	20.3564	20.3679	20.3680	20.3702	20.3634	20.3519	20.2739	20.0650	(90)
Living area fraction									fLA = Living area / (4) =			0.3370	(91)
MIT	20.3307	20.4785	20.5421	20.5687	20.5732	20.5809	20.5810	20.5824	20.5779	20.5684	20.4921	20.2928	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3307	20.4785	20.5421	20.5687	20.5732	20.5809	20.5810	20.5824	20.5779	20.5684	20.4921	20.2928	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8425	0.7157	0.5761	0.4310	0.3118	0.2118	0.1464	0.1618	0.2692	0.4793	0.7325	0.8692	(94)
Useful gains	660.9362	691.6463	641.9935	529.8378	402.2774	266.2236	177.2049	185.4711	290.4875	450.0389	581.2287	637.5157	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	748.5635	724.8350	650.9921	531.1672	402.4220	266.2311	177.2054	185.4720	290.5269	452.0934	611.8637	740.6597	(97)
Space heating kWh	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(98a)
Space heating requirement - total per year (kWh/year)												195.5822	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												195.5822	
Space heating per m2											(98c) / (4) =	2.9411	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 100.0000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5760	10.4558	11.5760	11.2026	11.5760	11.2026	11.5760	11.5760	11.2026	11.5760	11.2026	11.5760	(231)
Lighting	19.0422	15.2763	13.7546	10.0772	7.7840	6.3596	7.1008	9.2299	11.9887	15.7298	17.7668	19.5714	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.8374	-25.0495	-40.6440	-51.2425	-60.2341	-57.9825	-57.0592	-51.4970	-42.0573	-30.6737	-18.2140	-13.3632	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.1177	-7.4452	-16.6195	-27.6808	-38.7105	-39.7745	-39.2119	-31.7414	-21.6778	-11.4252	-4.4487	-2.3730	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year
Space heating fuel - main system 1 195.5822 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 100.0000
Water heating fuel used 2475.6013 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)
mechanical ventilation fans (SFP = 0.7000) 136.2984 (230a)
Total electricity for the above, kWh/year 136.2984 (231)
Electricity for lighting (calculated in Appendix L) 153.6812 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation -708.0805 (233)
Wind generation 0.0000 (234)
Hydro-electric generation (Appendix N) 0.0000 (235a)
Electricity generated - Micro CHP (Appendix N) 0.0000 (235)

Appendix Q - special features

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2253.0826	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	195.5822	16.4900	32.2515	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	16.4900	408.2267	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	136.2984	16.4900	22.4756	(249)
Energy for lighting	153.6812	16.4900	25.3420	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-463.8543	16.4900	-76.4896	
PV Unit electricity exported	-244.2261	5.5900	-13.6522	
Total			-90.1418	(252)
Total energy cost			398.1540	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2855	(257)
SAP value	79.1617	
SAP rating (Section 12)	79	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	195.5822	0.1606	31.4176	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2475.6013	0.1413	349.7834	(264)
Space and water heating			381.2010	(265)
Pumps, fans and electric keep-hot	136.2984	0.1387	18.9063	(267)
Energy for lighting	153.6812	0.1443	22.1809	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-463.8543	0.1323	-61.3768	
PV Unit electricity exported	-244.2261	0.1233	-30.1190	
Total			-91.4957	(269)
Total CO2, kg/year			330.7925	(272)
CO2 emissions per m2			4.9700	(273)
EI value			96.0246	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		66.5000 (1b)	x	2.4000 (2b)	=	159.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.5000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.6000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	43.9000	19.6900	24.2100	0.1400	3.3894	14.0000	338.9400	(29a)
Total net area of external elements Aum(A, m2)			43.9000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.7211			(33)
Party Wall 1			55.9300	0.0000	0.0000	20.0000	1118.6000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.5000			80.0000	5320.0000	(32d)
Party Ceiling 1			66.5000			80.0000	5320.0000	(32b)
Internal Wall 1			140.2900			9.0000	1262.6100	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13437.1500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 202.0624 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.1600	0.0700	1.1312
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	22.1400	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.0392 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 30.7603 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.1032	16.1032	15.7675	14.7602	14.5923	13.9208	13.5851	13.5851	14.2566	15.0960	15.4317	15.2638	(38)
Heat transfer coeff	46.8636	46.8636	46.5278	45.5206	45.3527	44.6812	44.3454	44.3454	45.0169	45.8563	46.1921	46.0242	(39)
Average = Sum(39)m / 12 =												45.6325	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7047	0.7047	0.6997	0.6845	0.6820	0.6719	0.6668	0.6668	0.6769	0.6896	0.6946	0.6921	(40)
HLP (average)												0.6862	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1583 (42)
Hot water usage for mixer showers

83.0588	81.8106	79.9917	76.5116	73.9433	71.0793	69.4513	71.2564	73.2352	76.3103	79.8652	82.7406	(42a)

Hot water usage for baths

26.1000	25.7123	25.1665	24.1600	23.4064	22.5708	22.1194	22.6614	23.2516	24.1458	25.1729	26.0117	(42b)

Hot water usage for other uses

36.7327	35.3969	34.0612	32.7255	31.3897	30.0540	30.0540	31.3897	32.7255	34.0612	35.3969	36.7327	(42c)

Average daily hot water use (litres/day) 134.1695 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.8914	142.9198	139.2194	133.3971	128.7395	123.7040	121.6247	125.3076	129.2122	134.5173	140.4351	145.4849	(44)
Energy conte	231.0563	203.5159	213.9750	182.6139	173.3081	152.1085	147.0945	155.1570	159.3316	182.5387	200.0755	227.7943	(45)
Energy content (annual)										Total = Sum(45)m =		2228.5693	
Distribution loss (46)m = 0.15 x (45)m	34.6584	30.5274	32.0962	27.3921	25.9962	22.8163	22.0642	23.2735	23.8997	27.3808	30.0113	34.1691	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)

Total per year (kWh/year) = Sum(64)m = 2475.6013 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

93.6109	82.8294	87.9313	76.9623	74.4096	66.8193	65.6936	68.3743	69.2210	77.4788	82.7683	92.5262	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.7552	19.3227	15.7143	11.8967	8.8930	7.5078	8.1125	10.5449	14.1533	17.9709	20.9747	22.3598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	282.0814	285.0085	277.6323	261.9291	242.1067	223.4764	211.0302	208.1031	215.4793	231.1825	251.0049	269.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	(71)
Water heating gains (Table 5)													
	125.8211	123.2580	118.1873	106.8921	100.0129	92.8046	88.2978	91.9010	96.1402	104.1381	114.9560	124.3632	(72)
Total internal gains													
	522.9304	520.8621	504.8066	473.9908	444.2853	417.0615	400.7133	403.8217	419.0457	446.5643	480.2084	509.6310	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	11.8100	33.4622	0.6300	0.8270	0.7700	142.6869	(77)
Southwest	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(79)

Solar gains	237.8920	432.4913	618.4356	806.0340	893.6844	862.2965	841.6682	750.0695	663.6383	475.1307	292.8315	208.1992	(83)
Total gains	760.8224	953.3534	1123.2423	1280.0248	1337.9696	1279.3581	1242.3814	1153.8912	1082.6839	921.6950	773.0399	717.8302	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000	(85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	79.6469	79.6469	80.2217	81.9968	82.3004	83.5373	84.1698	84.1698	82.9142	81.3965	80.8048	81.0996	
alpha	6.3098	6.3098	6.3481	6.4665	6.4867	6.5692	6.6113	6.6113	6.5276	6.4264	6.3870	6.4066	
util living area													
	0.8845	0.7655	0.6241	0.4641	0.3489	0.2724	0.2177	0.2383	0.3407	0.5560	0.7919	0.9054	(86)
MIT	20.7303	20.8890	20.9674	20.9952	20.9993	20.9999	21.0000	21.0000	20.9995	20.9880	20.8884	20.6918	(87)
Th 2	20.3367	20.3367	20.3411	20.3545	20.3568	20.3657	20.3702	20.3702	20.3612	20.3501	20.3456	20.3478	(88)
util rest of house													
	0.8685	0.7432	0.6000	0.4416	0.3272	0.2502	0.1952	0.2141	0.3143	0.5256	0.7669	0.8915	(89)
MIT 2	20.0414	20.2207	20.3088	20.3501	20.3562	20.3657	20.3702	20.3702	20.3609	20.3395	20.2318	20.0064	(90)
Living area fraction									fLA = Living area / (4) =			0.3370	(91)
MIT	20.2736	20.4459	20.5307	20.5675	20.5729	20.5794	20.5824	20.5824	20.5761	20.5580	20.4531	20.2374	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2736	20.4459	20.5307	20.5675	20.5729	20.5794	20.5824	20.5824	20.5761	20.5580	20.4531	20.2374	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8668	0.7469	0.6070	0.4491	0.3345	0.2577	0.2028	0.2222	0.3232	0.5354	0.7711	0.8889	(94)
Useful gains	659.5127	712.1003	681.7671	574.8005	447.5175	329.6864	251.9844	256.4141	349.9080	493.4880	596.1068	638.1040	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	767.3236	756.6545	694.6943	576.6309	447.7632	329.7195	251.9897	256.4237	350.0571	497.9093	639.9012	761.1189	(97)
Space heating kWh													
	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(98a)
Space heating requirement - total per year (kWh/year)												247.6148	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												247.6148	
Space heating per m2										(98c) / (4) =		3.7235	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(219)
Space cooling fuel requirement													

(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5760	10.4558	11.5760	11.2026	11.5760	11.2026	11.5760	11.5760	11.2026	11.5760	11.2026	11.5760	(231)
Lighting	19.0422	15.2763	13.7546	10.0772	7.7840	6.3596	7.1008	9.2299	11.9887	15.7298	17.7668	19.5714	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.3659	-24.1373	-40.6748	-53.4156	-62.3565	-58.8247	-58.3796	-51.5126	-41.7801	-29.4038	-16.9601	-12.3644	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.6228	-6.9252	-16.5691	-29.8250	-41.2999	-40.8780	-40.9539	-31.7592	-21.4223	-10.5980	-3.9084	-2.0636	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	247.6148	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2475.6013	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.2984	(230a)
Total electricity for the above, kWh/year	136.2984	(231)
Electricity for lighting (calculated in Appendix L)	153.6812	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-713.0011	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2300.1947	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	247.6148	25.1600	62.2999	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	25.1600	622.8613	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	136.2984	25.1600	34.2927	(249)
Energy for lighting	153.6812	25.1600	38.6662	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.1755	25.1600	-116.7865	
PV Unit electricity exported	-248.8256	5.8100	-14.4568	
Total			-131.2433	(252)
Total energy cost			626.8767	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	247.6148	0.1602	39.6760	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2475.6013	0.1413	349.7834	(264)
Space and water heating			389.4594	(265)
Pumps, fans and electric keep-hot	136.2984	0.1387	18.9063	(267)
Energy for lighting	153.6812	0.1443	22.1809	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.1755	0.1320	-61.2773	
PV Unit electricity exported	-248.8256	0.1228	-30.5608	
Total			-91.8382	(269)
Total CO2, kg/year			338.7085	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	247.6148	1.5930	394.4398	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	1.5225	3769.0221	(278)
Space and water heating			4163.4620	(279)
Pumps, fans and electric keep-hot	136.2984	1.5128	206.1922	(281)
Energy for lighting	153.6812	1.5338	235.7213	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.1755	1.4878	-690.5810	
PV Unit electricity exported	-248.8256	0.4508	-112.1583	
Total			-802.7393	(283)
Total Primary energy kWh/year			3802.6362	(286)

SAP 10 EPC IMPROVEMENTS

Unit 417 L02_Copy

Current energy efficiency rating: C 79
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 79
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£758	£758	£0
Space heating	£97	£97	£0
Water heating	£623	£623	£0
Lighting	£39	£39	£0
Generated (PV)	-£131	-£131	£0
Total cost of fuels	£627	£627	£0
Total cost of uses	£628	£628	£0
Delivered energy	35 kWh/m²	35 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	57 kWh/m²	57 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.5000 (1b)	x	2.4000 (2b)	=	159.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.6000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	43.9000	19.6900	24.2100	0.1400	3.3894	14.0000	338.9400	(29a)
Total net area of external elements Aum(A, m2)			43.9000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.7211			(33)
Party Wall 1			55.9300	0.0000	0.0000	20.0000	1118.6000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.5000			80.0000	5320.0000	(32d)
Party Ceiling 1			66.5000			80.0000	5320.0000	(32b)
Internal Wall 1			140.2900			9.0000	1262.6100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13437.1500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.0624 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.1600	0.0700	1.1312
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	22.1400	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.0392 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	30.7603 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.9354	15.7675	15.5996	14.7602	14.5923	13.7529	13.7529	13.5851	14.0887	14.5923	14.9281	15.2638	(38)
Heat transfer coeff	46.6957	46.5278	46.3600	45.5206	45.3527	44.5133	44.5133	44.3454	44.8490	45.3527	45.6884	46.0242	(39)
Average = Sum(39)m / 12 =												45.4786	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7022	0.6997	0.6971	0.6845	0.6820	0.6694	0.6694	0.6668	0.6744	0.6820	0.6870	0.6921	(40)
HLP (average)												0.6839	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.1583 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
83.0588	81.8106	79.9917	76.5116	73.9433	71.0793	69.4513	71.2564	73.2352	76.3103	79.8652	82.7406	(42a)

Hot water usage for baths

26.1000	25.7123	25.1665	24.1600	23.4064	22.5708	22.1194	22.6614	23.2516	24.1458	25.1729	26.0117	(42b)

Hot water usage for other uses

36.7327	35.3969	34.0612	32.7255	31.3897	30.0540	30.0540	31.3897	32.7255	34.0612	35.3969	36.7327	(42c)

Average daily hot water use (litres/day)		134.1695 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.8914	142.9198	139.2194	133.3971	128.7395	123.7040	121.6247	125.3076	129.2122	134.5173	140.4351	145.4849	(44)
Energy conte	231.0563	203.5159	213.9750	182.6139	173.3081	152.1085	147.0945	155.1570	159.3316	182.5387	200.0755	227.7943	(45)
Energy content (annual)										Total = Sum(45)m =		2228.5693	

Distribution loss (46)m = 0.15 x (45)m

34.6584	30.5274	32.0962	27.3921	25.9962	22.8163	22.0642	23.2735	23.8997	27.3808	30.0113	34.1691	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
									Total per year (kWh/year) = Sum(64)m =		2475.6013	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

93.6109	82.8294	87.9313	76.9623	74.4096	66.8193	65.6936	68.3743	69.2210	77.4788	82.7683	92.5262	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7552	19.3227	15.7143	11.8967	8.8930	7.5078	8.1125	10.5449	14.1533	17.9709	20.9747	22.3598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	282.0814	285.0085	277.6323	261.9291	242.1067	223.4764	211.0302	208.1031	215.4793	231.1825	251.0049	269.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	(71)
Water heating gains (Table 5)	125.8211	123.2580	118.1873	106.8921	100.0129	92.8046	88.2978	91.9010	96.1402	104.1381	114.9560	124.3632	(72)
Total internal gains	522.9304	520.8621	504.8066	473.9908	444.2853	417.0615	400.7133	403.8217	419.0457	446.5643	480.2084	509.6310	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	11.8100	36.7938	0.6300	0.8270	0.7700	156.8932	(77)
Southwest	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	261.5773	445.5629	609.6386	755.3718	846.0793	839.9609	809.8120	742.1401	660.1097	492.4419	313.3093	223.8557	(83)
Total gains	784.5077	966.4250	1114.4452	1229.3625	1290.3646	1257.0225	1210.5252	1145.9618	1079.1553	939.0062	793.5177	733.4867	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	79.9333	80.2217	80.5122	81.9968	82.3004	83.8523	83.8523	84.1698	83.2246	82.3004	81.6955	81.0996	
alpha	6.3289	6.3481	6.3675	6.4665	6.4867	6.5902	6.5902	6.6113	6.5483	6.4867	6.4464	6.4066	
util living area	0.8610	0.7342	0.5934	0.4467	0.3267	0.2266	0.1618	0.1780	0.2867	0.4994	0.7534	0.8867	(86)
MIT	20.7806	20.9169	20.9770	20.9964	20.9996	21.0000	21.0000	21.0000	20.9999	20.9943	20.9214	20.7412	(87)
Th 2	20.3389	20.3411	20.3434	20.3545	20.3568	20.3680	20.3680	20.3702	20.3635	20.3568	20.3523	20.3478	(88)
util rest of house	0.8427	0.7107	0.5685	0.4232	0.3042	0.2042	0.1386	0.1536	0.2603	0.4693	0.7265	0.8706	(89)
MIT 2	20.1020	20.2557	20.3211	20.3513	20.3564	20.3679	20.3680	20.3702	20.3634	20.3519	20.2739	20.0650	(90)
Living area fraction										fLA = Living area / (4) =		0.3370	(91)
MIT	20.3307	20.4785	20.5421	20.5687	20.5732	20.5809	20.5810	20.5824	20.5779	20.5684	20.4921	20.2928	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3307	20.4785	20.5421	20.5687	20.5732	20.5809	20.5810	20.5824	20.5779	20.5684	20.4921	20.2928	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8425	0.7157	0.5761	0.4310	0.3118	0.2118	0.1464	0.1618	0.2692	0.4793	0.7325	0.8692	(94)
Useful gains	660.9362	691.6463	641.9935	529.8378	402.2774	266.2236	177.2049	185.4711	290.4875	450.0389	581.2287	637.5157	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	748.5635	724.8350	650.9921	531.1672	402.4220	266.2311	177.2054	185.4720	290.5269	452.0934	611.8637	740.6597	(97)
Space heating kWh	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(98a)
Space heating requirement - total per year (kWh/year)												195.5822	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												195.5822	
Space heating per m2										(98c) / (4) =		2.9411	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	65.1947	22.3028	6.6950	0.9572	0.1075	0.0000	0.0000	0.0000	0.0000	1.5285	22.0572	76.7392	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5760	10.4558	11.5760	11.2026	11.5760	11.2026	11.5760	11.5760	11.2026	11.5760	11.2026	11.5760	(231)
Lighting	19.0422	15.2763	13.7546	10.0772	7.7840	6.3596	7.1008	9.2299	11.9887	15.7298	17.7668	19.5714	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.8374	-25.0495	-40.6440	-51.2425	-60.2341	-57.9825	-57.0592	-51.4970	-42.0573	-30.6737	-18.2140	-13.3632	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.1177	-7.4452	-16.6195	-27.6808	-38.7105	-39.7745	-39.2119	-31.7414	-21.6778	-11.4252	-4.4487	-2.3730	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	195.5822	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2475.6013	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.2984	(230a)
Total electricity for the above, kWh/year	136.2984	(231)
Electricity for lighting (calculated in Appendix L)	153.6812	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-708.0805	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2253.0826	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	195.5822	16.4900	32.2515	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	16.4900	408.2267	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	136.2984	16.4900	22.4756	(249)
Energy for lighting	153.6812	16.4900	25.3420	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-463.8543	16.4900	-76.4896	
PV Unit electricity exported	-244.2261	5.5900	-13.6522	
Total			-90.1418	(252)
Total energy cost			398.1540	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2855	(257)
SAP value	79.1617	
SAP rating (Section 12)	79	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	195.5822	0.1606	31.4176	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2475.6013	0.1413	349.7834	(264)
Space and water heating			381.2010	(265)
Pumps, fans and electric keep-hot	136.2984	0.1387	18.9063	(267)
Energy for lighting	153.6812	0.1443	22.1809	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-463.8543	0.1323	-61.3768	
PV Unit electricity exported	-244.2261	0.1233	-30.1190	
Total			-91.4957	(269)
Total CO2, kg/year			330.7925	(272)
CO2 emissions per m2			4.9700	(273)
EI value			96.0246	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.5000	(1b)	x 2.4000	(2b) =	159.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		159.6000	(5)

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2. Ventilation rate

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m3 per hour

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery		
If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	43.9000	19.6900	24.2100	0.1400	3.3894	14.0000	338.9400	(29a)
Total net area of external elements Aum(A, m2)			43.9000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.7211			(33)
Party Wall 1			55.9300	0.0000	0.0000	20.0000	1118.6000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.5000			80.0000	5320.0000	(32d)
Party Ceiling 1			66.5000			80.0000	5320.0000	(32b)
Internal Wall 1			140.2900			9.0000	1262.6100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13437.1500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.0624 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.1600	0.0700	1.1312
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	22.1400	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.0392 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	30.7603 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.1032	16.1032	15.7675	14.7602	14.5923	13.9208	13.5851	13.5851	14.2566	15.0960	15.4317	15.2638	(38)
Heat transfer coeff	46.8636	46.8636	46.5278	45.5206	45.3527	44.6812	44.3454	44.3454	45.0169	45.8563	46.1921	46.0242	(39)
Average = Sum(39)m / 12 =												45.6325	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7047	0.7047	0.6997	0.6845	0.6820	0.6719	0.6668	0.6668	0.6769	0.6896	0.6946	0.6921	(40)
HLP (average)												0.6862	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.1583 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
83.0588	81.8106	79.9917	76.5116	73.9433	71.0793	69.4513	71.2564	73.2352	76.3103	79.8652	82.7406	(42a)

Hot water usage for baths

26.1000	25.7123	25.1665	24.1600	23.4064	22.5708	22.1194	22.6614	23.2516	24.1458	25.1729	26.0117	(42b)

Hot water usage for other uses

36.7327	35.3969	34.0612	32.7255	31.3897	30.0540	30.0540	31.3897	32.7255	34.0612	35.3969	36.7327	(42c)

Average daily hot water use (litres/day)		134.1695 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.8914	142.9198	139.2194	133.3971	128.7395	123.7040	121.6247	125.3076	129.2122	134.5173	140.4351	145.4849	(44)
Energy conte	231.0563	203.5159	213.9750	182.6139	173.3081	152.1085	147.0945	155.1570	159.3316	182.5387	200.0755	227.7943	(45)
Energy content (annual)										Total = Sum(45)m =		2228.5693	
Distribution loss (46)m = 0.15 x (45)m	34.6584	30.5274	32.0962	27.3921	25.9962	22.8163	22.0642	23.2735	23.8997	27.3808	30.0113	34.1691	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
										Total per year (kWh/year) = Sum(64)m =		2475.6013	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	93.6109	82.8294	87.9313	76.9623	74.4096	66.8193	65.6936	68.3743	69.2210	77.4788	82.7683	92.5262	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	129.4951	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.7552	19.3227	15.7143	11.8967	8.8930	7.5078	8.1125	10.5449	14.1533	17.9709	20.9747	22.3598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	282.0814	285.0085	277.6323	261.9291	242.1067	223.4764	211.0302	208.1031	215.4793	231.1825	251.0049	269.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	50.1078	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	-86.3301	(71)
Water heating gains (Table 5)													
	125.8211	123.2580	118.1873	106.8921	100.0129	92.8046	88.2978	91.9010	96.1402	104.1381	114.9560	124.3632	(72)
Total internal gains													
	522.9304	520.8621	504.8066	473.9908	444.2853	417.0615	400.7133	403.8217	419.0457	446.5643	480.2084	509.6310	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	11.8100	33.4622	0.6300	0.8270	0.7700	142.6869	(77)
Southwest	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(79)

Solar gains	237.8920	432.4913	618.4356	806.0340	893.6844	862.2965	841.6682	750.0695	663.6383	475.1307	292.8315	208.1992	(83)
Total gains	760.8224	953.3534	1123.2423	1280.0248	1337.9696	1279.3581	1242.3814	1153.8912	1082.6839	921.6950	773.0399	717.8302	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	79.6469	79.6469	80.2217	81.9968	82.3004	83.5373	84.1698	84.1698	82.9142	81.3965	80.8048	81.0996	
alpha	6.3098	6.3098	6.3481	6.4665	6.4867	6.5692	6.6113	6.6113	6.5276	6.4264	6.3870	6.4066	
util living area													
	0.8845	0.7655	0.6241	0.4641	0.3489	0.2724	0.2177	0.2383	0.3407	0.5560	0.7919	0.9054	(86)
MIT	20.7303	20.8890	20.9674	20.9952	20.9993	20.9999	21.0000	21.0000	20.9995	20.9880	20.8884	20.6918	(87)
Th 2	20.3367	20.3367	20.3411	20.3545	20.3568	20.3657	20.3702	20.3702	20.3612	20.3501	20.3456	20.3478	(88)
util rest of house													
	0.8685	0.7432	0.6000	0.4416	0.3272	0.2502	0.1952	0.2141	0.3143	0.5256	0.7669	0.8915	(89)
MIT 2	20.0414	20.2207	20.3088	20.3501	20.3562	20.3657	20.3702	20.3702	20.3609	20.3395	20.2318	20.0064	(90)
Living area fraction										fLA = Living area / (4) =		0.3370	(91)
MIT	20.2736	20.4459	20.5307	20.5675	20.5729	20.5794	20.5824	20.5824	20.5761	20.5580	20.4531	20.2374	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2736	20.4459	20.5307	20.5675	20.5729	20.5794	20.5824	20.5824	20.5761	20.5580	20.4531	20.2374	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8668	0.7469	0.6070	0.4491	0.3345	0.2577	0.2028	0.2222	0.3232	0.5354	0.7711	0.8889	(94)
Useful gains	659.5127	712.1003	681.7671	574.8005	447.5175	329.6864	251.9844	256.4141	349.9080	493.4880	596.1068	638.1040	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	767.3236	756.6545	694.6943	576.6309	447.7632	329.7195	251.9897	256.4237	350.0571	497.9093	639.9012	761.1189	(97)
Space heating kWh													
	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(98a)
Space heating requirement - total per year (kWh/year)												247.6148	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												247.6148	
Space heating per m2											(98c) / (4) =	3.7235	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement												

	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	80.2113	29.9404	9.6178	1.3179	0.1828	0.0000	0.0000	0.0000	0.0000	3.2895	31.5320	91.5231	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	252.0371	222.4663	234.9558	202.9179	194.2889	172.4125	168.0753	176.1378	179.6356	203.5195	220.3795	248.7751	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5760	10.4558	11.5760	11.2026	11.5760	11.2026	11.5760	11.5760	11.2026	11.5760	11.2026	11.5760	(231)
Lighting	19.0422	15.2763	13.7546	10.0772	7.7840	6.3596	7.1008	9.2299	11.9887	15.7298	17.7668	19.5714	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.3659	-24.1373	-40.6748	-53.4156	-62.3565	-58.8247	-58.3796	-51.5126	-41.7801	-29.4038	-16.9601	-12.3644	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.6228	-6.9252	-16.5691	-29.8250	-41.2999	-40.8780	-40.9539	-31.7592	-21.4223	-10.5980	-3.9084	-2.0636	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	247.6148	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2475.6013	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.2984	(230a)
Total electricity for the above, kWh/year	136.2984	(231)
Electricity for lighting (calculated in Appendix L)	153.6812	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-713.0011	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2300.1947	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	247.6148	25.1600	62.2999	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	25.1600	622.8613	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	136.2984	25.1600	34.2927	(249)
Energy for lighting	153.6812	25.1600	38.6662	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.1755	25.1600	-116.7865	
PV Unit electricity exported	-248.8256	5.8100	-14.4568	
Total			-131.2433	(252)
Total energy cost			626.8767	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	247.6148	0.1602	39.6760	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2475.6013	0.1413	349.7834	(264)
Space and water heating			389.4594	(265)
Pumps, fans and electric keep-hot	136.2984	0.1387	18.9063	(267)
Energy for lighting	153.6812	0.1443	22.1809	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.1755	0.1320	-61.2773	
PV Unit electricity exported	-248.8256	0.1228	-30.5608	
Total			-91.8382	(269)
Total CO2, kg/year			338.7085	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	

Space heating - main system 1	247.6148	1.5930	394.4398	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2475.6013	1.5225	3769.0221	(278)
Space and water heating			4163.4620	(279)
Pumps, fans and electric keep-hot	136.2984	1.5128	206.1922	(281)
Energy for lighting	153.6812	1.5338	235.7213	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.1755	1.4878	-690.5810	
PV Unit electricity exported	-248.8256	0.4508	-112.1583	
Total			-802.7393	(283)
Total Primary energy kWh/year			3802.6362	(286)

Predicted Energy Assessment

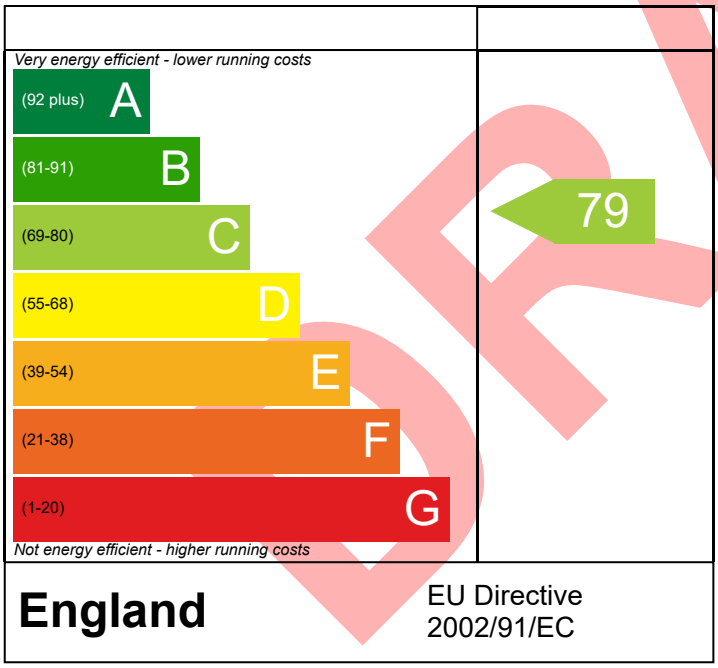
elmhurst energy

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	66.5 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

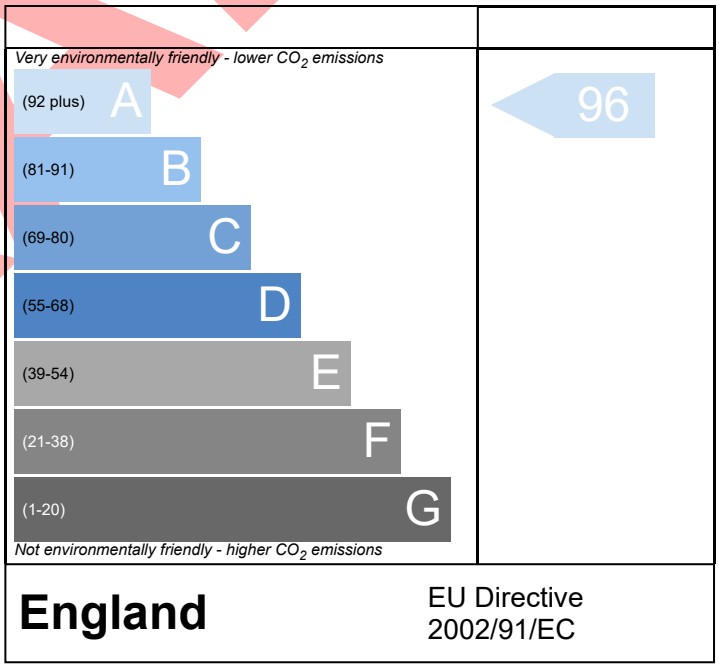
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:31

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	49 m^2
Site Reference	Unit 422 L02_Copy	Plot Reference	Unit 422 L02_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.76 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	5.62 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*64.05 kWh$_{PE}$/m^2*	
Dwelling primary energy	63.13 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*14.3 kWh/m^2*	
Dwelling fabric energy efficiency	13.6 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	7.88	0.14 **(!)**
Party wall: Party Wall (1)	24.84	0 **(!)**
Party wall: Party Wall (2)	39.01	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	6.29	North East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.63 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 422 L02_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 422 L02_Copy	**Prop Type Ref**	Unit 422 L02
Property			

SAP Rating	79 C	**DER**	5.62	**TER**	11.76
Environmental	96 A	**% DER < TER**			52.21
CO_2 Emissions (t/year)	0.27	**DFEE**	13.63	**TFEE**	14.31
Compliance Check	See BREL	**% DFEE < TFEE**			4.74
% DPER < TPER	1.44	**DPER**	63.13	**TPER**	64.05

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.8100	(1b)	x 2.4000	(2b) =	117.1440	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.8100					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		117.1440	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.2900	1.2357	7.7728			(27)
External Wall 1	14.1700	6.2900	7.8800	0.1400	1.1032	14.0000	110.3200	(29a)
Total net area of external elements Aum(A, m2)			14.1700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		8.8760			(33)
Party Wall 1			24.8400	0.0000	0.0000	20.0000	496.8000	(32)
Wall to corridor			39.0100	0.0000	0.0000	20.0000	780.2000	(32)
Party Floor 1			48.8100			80.0000	3904.8000	(32d)
Party Ceiling 1			48.8100			80.0000	3904.8000	(32b)
Internal Wall 1			72.6800			9.0000	654.1200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9851.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		201.8242 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	1.8200	0.0500	0.0910

E4 Jamb	9.2800	0.0500	0.4640	
E7 Party floor between dwellings (in blocks of flats)	5.2500	0.0700	0.3675	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	20.8400	0.0000	0.0000	
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.2465 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 10.1225 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.1418	11.0295	10.9171	10.3554	10.2430	9.6813	9.6813	9.5689	9.9060	10.2430	10.4677	10.6924	(38)
Heat transfer coeff	21.2643	21.1520	21.0396	20.4779	20.3655	19.8038	19.8038	19.6915	20.0285	20.3655	20.5902	20.8149	(39)
Average = Sum(39)m / 12 =												20.4498	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4357	0.4334	0.4311	0.4195	0.4172	0.4057	0.4057	0.4034	0.4103	0.4172	0.4218	0.4264	(40)
HLP (average)												0.4190	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6551 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
71.4595	70.3856	68.8207	65.8266	63.6170	61.1529	59.7523	61.3053	63.0077	65.6534	68.7119	71.1857	(42a)

Hot water usage for baths

22.4723	22.1385	21.6685	20.8020	20.1531	19.4336	19.0450	19.5117	20.0198	20.7897	21.6741	22.3963	(42b)

Hot water usage for other uses

31.5802	30.4318	29.2834	28.1350	26.9867	25.8383	25.8383	26.9867	28.1350	29.2834	30.4318	31.5802	(42c)

Average daily hot water use (litres/day) 115.4278 (43)

Daily hot water use

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
125.5119	122.9558	119.7726	114.7636	110.7568	106.4248	104.6356	107.8037	111.1626	115.7265	120.8177	125.1621	(44)
Energy conte 198.7801	175.0875	184.0861	157.1056	149.0999	130.8617	126.5476	133.4834	137.0746	157.0398	172.1270	195.9736	(45)
Energy content (annual)										Total = Sum(45)m =		1917.2669	
Distribution loss (46)m = 0.15 x (45)m													
29.8170	26.2631	27.6129	23.5658	22.3650	19.6293	18.9821	20.0225	20.5612	23.5560	25.8191	29.3960	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
									Total per year (kWh/year) = Sum(64)m =		2164.2989	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

82.8790	73.3769	77.9933	68.4808	66.3603	59.7547	58.8617	61.1679	61.8205	69.0004	73.4754	81.9459	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	(66)m

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

17.4855	15.5304	12.6302	9.5619	7.1476	6.0343	6.5203	8.4753	11.3756	14.4439	16.8582	17.9715	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

215.1398	217.3723	211.7465	199.7699	184.6516	170.4425	160.9500	158.7175	164.3433	176.3199	191.4382	205.6473	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	(71)

Water heating gains (Table 5)

111.3965	109.1918	104.8296	95.1122	89.1940	82.9927	79.1152	82.2149	85.8618	92.7424	102.0492	110.1423	(72)

Total internal gains

423.7103	421.7830	408.8948	384.1325	360.6817	339.1579	326.2739	329.0962	341.2691	363.1946	390.0340	413.4494	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.2900	11.2829	0.6300	0.8270	0.7700	25.6243	(75)

Solar gains	25.6243	52.1590	93.9740	154.3323	207.4529	221.1667	206.8969	164.9406	114.5088	63.7425	32.2420	20.9261	(83)
Total gains	449.3346	473.9420	502.8688	538.4647	568.1345	560.3246	533.1709	494.0368	455.7778	426.9371	422.2760	434.3755	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	128.6850	129.3685	130.0593	133.6270	134.3642	138.1755	138.1755	138.9638	136.6253	134.3642	132.8979	131.4633	
alpha	9.5790	9.6246	9.6706	9.9085	9.9576	10.2117	10.2117	10.2643	10.1084	9.9576	9.8599	9.7642	
util living area	0.7713	0.7099	0.6048	0.4601	0.3334	0.2262	0.1634	0.1833	0.3032	0.4959	0.6730	0.7841	(86)
MIT	20.9739	20.9874	20.9971	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9997	20.9938	20.9721	(87)
Th 2	20.5802	20.5823	20.5844	20.5951	20.5973	20.6080	20.6080	20.6101	20.6037	20.5973	20.5930	20.5887	(88)
util rest of house	0.7549	0.6930	0.5878	0.4447	0.3189	0.2123	0.1489	0.1678	0.2858	0.4767	0.6543	0.7681	(89)
MIT 2	20.5528	20.5694	20.5815	20.5950	20.5973	20.6080	20.6080	20.6101	20.6037	20.5970	20.5869	20.5593	(90)
Living area fraction									fLA = Living area / (4) =			0.5530	(91)
MIT	20.7856	20.8006	20.8113	20.8188	20.8200	20.8248	20.8248	20.8257	20.8228	20.8197	20.8119	20.7876	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7856	20.8006	20.8113	20.8188	20.8200	20.8248	20.8248	20.8257	20.8228	20.8197	20.8119	20.7876	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7630	0.7018	0.5971	0.4532	0.3269	0.2200	0.1569	0.1764	0.2954	0.4873	0.6644	0.7759	(94)
Useful gains	342.8519	332.6341	300.2537	244.0199	185.7311	123.2738	83.6662	87.1488	134.6479	208.0459	280.5415	337.0476	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	350.5562	336.3282	301.1047	244.0725	185.7329	123.2738	83.6662	87.1488	134.6483	208.1293	282.3311	345.2694	(97)
Space heating kWh	5.7320	2.4825	0.6331	0.0378	0.0014	0.0000	0.0000	0.0000	0.0000	0.0620	1.2885	6.1170	(98a)
Space heating requirement - total per year (kWh/year)												16.3544	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	5.7320	2.4825	0.6331	0.0378	0.0014	0.0000	0.0000	0.0000	0.0000	0.0620	1.2885	6.1170	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												16.3544	
Space heating per m2											(98c) / (4) =	0.3351	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 100.0000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	5.7320	2.4825	0.6331	0.0378	0.0014	0.0000	0.0000	0.0000	0.0000	0.0620	1.2885	6.1170	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	5.7320	2.4825	0.6331	0.0378	0.0014	0.0000	0.0000	0.0000	0.0000	0.0620	1.2885	6.1170	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.4966	7.6744	8.4966	8.2225	8.4966	8.2225	8.4966	8.4966	8.2225	8.4966	8.2225	8.4966	(231)
Lighting	15.3049	12.2782	11.0551	8.0995	6.2563	5.1114	5.7072	7.4184	9.6358	12.6427	14.2798	15.7303	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.6121	-18.5297	-30.3050	-38.4595	-45.4028	-43.7828	-43.0940	-38.8073	-31.5720	-22.8789	-13.4503	-9.7803	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.2735	-5.2746	-11.6439	-19.3564	-27.0799	-27.8299	-27.4302	-22.1697	-15.1176	-7.9609	-3.1515	-1.7474	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year
Space heating fuel - main system 1 16.3544 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 100.0000
Water heating fuel used 2164.2989 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)
mechanical ventilation fans (SFP = 0.7000) 100.0410 (230a)
Total electricity for the above, kWh/year 100.0410 (231)
Electricity for lighting (calculated in Appendix L) 123.5196 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation -518.7101 (233)
Wind generation 0.0000 (234)
Hydro-electric generation (Appendix N) 0.0000 (235a)
Electricity generated - Micro CHP (Appendix N) 0.0000 (235)

Appendix Q - special features

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1885.5037	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	16.3544	16.4900	2.6968	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	16.4900	356.8929	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	100.0410	16.4900	16.4968	(249)
Energy for lighting	123.5196	16.4900	20.3684	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.6746	16.4900	-57.3315	
PV Unit electricity exported	-171.0355	5.5900	-9.5609	
Total			-66.8924	(252)
Total energy cost			329.5624	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2647	(257)
SAP value	79.4990	
SAP rating (Section 12)	79	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	16.3544	0.1611	2.6341	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2164.2989	0.1413	305.7097	(264)
Space and water heating			308.3438	(265)
Pumps, fans and electric keep-hot	100.0410	0.1387	13.8769	(267)
Energy for lighting	123.5196	0.1443	17.8277	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.6746	0.1322	-45.9593	
PV Unit electricity exported	-171.0355	0.1234	-21.1140	
Total			-67.0734	(269)
Total CO2, kg/year			272.9750	(272)
CO2 emissions per m2			5.5900	(273)
EI value			96.1008	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.8100	(1b)	x 2.4000	(2b) =	117.1440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 48.8100						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		117.1440	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 = 0.0000	(6a)
Number of open flues	0 * 20 = 0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000	(6d)
Number of flues attached to other heater	0 * 35 = 0.0000	(6e)
Number of blocked chimneys	0 * 20 = 0.0000	(6f)
Number of intermittent extract fans	0 * 10 = 0.0000	(7a)
Number of passive vents	0 * 10 = 0.0000	(7b)
Number of flueless gas fires	0 * 40 = 0.0000	(7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000	(8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	3.0000	(17)
Infiltration rate	0.1500	(18)
Number of sides sheltered	3	(19)
Shelter factor (20) = 1 - [0.075 x (19)] =	0.7750	(20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.2900	1.2357	7.7728			(27)
External Wall 1	14.1700	6.2900	7.8800	0.1400	1.1032	14.0000	110.3200	(29a)
Total net area of external elements Aum(A, m2)			14.1700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	8.8760			(33)
Party Wall 1			24.8400	0.0000	0.0000	20.0000	496.8000	(32)
Wall to corridor			39.0100	0.0000	0.0000	20.0000	780.2000	(32)
Party Floor 1			48.8100			80.0000	3904.8000	(32d)
Party Ceiling 1			48.8100			80.0000	3904.8000	(32b)
Internal Wall 1			72.6800			9.0000	654.1200	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9851.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 201.8242 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	1.8200	0.0500	0.0910
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.2500	0.0700	0.3675
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	20.8400	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.2465 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 10.1225 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.2542	11.2542	11.0295	10.3554	10.2430	9.7936	9.5689	9.5689	10.0183	10.5801	10.8048	10.6924	(38)
Heat transfer coeff	21.3767	21.3767	21.1520	20.4779	20.3655	19.9162	19.6915	19.6915	20.1409	20.7026	20.9273	20.8149	(39)

Average = Sum(39)m / 12 = 20.5528

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4380	0.4380	0.4334	0.4195	0.4172	0.4080	0.4034	0.4034	0.4126	0.4241	0.4288	0.4264	(40)
HLP (average)												0.4211	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6551 (42)
Hot water usage for mixer showers

71.4595	70.3856	68.8207	65.8266	63.6170	61.1529	59.7523	61.3053	63.0077	65.6534	68.7119	71.1857	(42a)

Hot water usage for baths

22.4723	22.1385	21.6685	20.8020	20.1531	19.4336	19.0450	19.5117	20.0198	20.7897	21.6741	22.3963	(42b)

Hot water usage for other uses

31.5802	30.4318	29.2834	28.1350	26.9867	25.8383	25.8383	26.9867	28.1350	29.2834	30.4318	31.5802	(42c)

Average daily hot water use (litres/day) 115.4278 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	125.5119	122.9558	119.7726	114.7636	110.7568	106.4248	104.6356	107.8037	111.1626	115.7265	120.8177	125.1621	(44)
Energy conte	198.7801	175.0875	184.0861	157.1056	149.0999	130.8617	126.5476	133.4834	137.0746	157.0398	172.1270	195.9736	(45)

Energy content (annual) Total = Sum(45)m = 1917.2669

Distribution loss (46)m = 0.15 x (45)m												
29.8170	26.2631	27.6129	23.5658	22.3650	19.6293	18.9821	20.0225	20.5612	23.5560	25.8191	29.3960	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h												
219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)

Total per year (kWh/year) = Sum(64)m = 2164.2989 (64)

Electric shower(s)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month												
82.8790	73.3769	77.9933	68.4808	66.3603	59.7547	58.8617	61.1679	61.8205	69.0004	73.4754	81.9459	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	17.4855	15.5304	12.6302	9.5619	7.1476	6.0343	6.5203	8.4753	11.3756	14.4439	16.8582	17.9715	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	215.1398	217.3723	211.7465	199.7699	184.6516	170.4425	160.9500	158.7175	164.3433	176.3199	191.4382	205.6473	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	(71)

Water heating gains (Table 5)

	111.3965	109.1918	104.8296	95.1122	89.1940	82.9927	79.1152	82.2149	85.8618	92.7424	102.0492	110.1423	(72)

Total internal gains

	423.7103	421.7830	408.8948	384.1325	360.6817	339.1579	326.2739	329.0962	341.2691	363.1946	390.0340	413.4494	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.2900	10.0309	0.6300	0.8270	0.7700	22.7809	(75)

Solar gains	22.7809	49.3199	92.7016	160.6228	214.7931	223.1785	211.1088	162.9125	112.0170	59.8425	29.4243	19.0490	(83)
Total gains	446.4911	471.1029	501.5964	544.7552	575.4748	562.3364	537.3828	492.0087	453.2861	423.0371	419.4582	432.4984	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	128.0086	128.0086	129.3685	133.6270	134.3642	137.3960	138.9638	138.9638	135.8632	132.1767	130.7575	131.4633	
alpha	9.5339	9.5339	9.6246	9.9085	9.9576	10.1597	10.2643	10.2643	10.0575	9.8118	9.7172	9.7642	
util living area	0.7936	0.7440	0.6458	0.4922	0.3645	0.2763	0.2235	0.2481	0.3643	0.5523	0.7101	0.8055	(86)
MIT	20.9657	20.9801	20.9945	20.9996	21.0000	21.0000	21.0000	21.0000	21.0000	20.9990	20.9892	20.9641	(87)
Th 2	20.5780	20.5780	20.5823	20.5951	20.5973	20.6058	20.6101	20.6101	20.6016	20.5908	20.5866	20.5887	(88)
util rest of house	0.7777	0.7274	0.6290	0.4771	0.3502	0.2623	0.2092	0.2325	0.3466	0.5325	0.6913	0.7903	(89)
MIT 2	20.5416	20.5573	20.5767	20.5948	20.5973	20.6058	20.6101	20.6101	20.6015	20.5900	20.5758	20.5504	(90)
Living area fraction										fLA = Living area / (4) =		0.5530	(91)
MIT	20.7761	20.7911	20.8077	20.8186	20.8199	20.8238	20.8257	20.8257	20.8219	20.8162	20.8044	20.7791	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7761	20.7911	20.8077	20.8186	20.8199	20.8238	20.8257	20.8257	20.8219	20.8162	20.8044	20.7791	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7853	0.7358	0.6381	0.4854	0.3581	0.2700	0.2171	0.2412	0.3564	0.5434	0.7012	0.7974	(94)
Useful gains	350.6097	346.6573	320.0551	264.4405	206.0934	151.8365	116.6859	118.6550	161.5640	229.8661	294.1317	344.8822	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	360.7559	352.5253	321.6735	264.5466	206.0982	151.8367	116.6859	118.6551	161.5672	230.1336	297.2597	355.5011	(97)
Space heating kWh	7.5487	3.9433	1.2041	0.0764	0.0036	0.0000	0.0000	0.0000	0.0000	0.1990	2.2521	7.9005	(98a)
Space heating requirement - total per year (kWh/year)												23.1277	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	7.5487	3.9433	1.2041	0.0764	0.0036	0.0000	0.0000	0.0000	0.0000	0.1990	2.2521	7.9005	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												23.1277	
Space heating per m2										(98c) / (4) =		0.4738	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	7.5487	3.9433	1.2041	0.0764	0.0036	0.0000	0.0000	0.0000	0.0000	0.1990	2.2521	7.9005	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	7.5487	3.9433	1.2041	0.0764	0.0036	0.0000	0.0000	0.0000	0.0000	0.1990	2.2521	7.9005	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating

Water heating requirement

	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(219)

Space cooling fuel requirement

(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.4966	7.6744	8.4966	8.2225	8.4966	8.2225	8.4966	8.4966	8.2225	8.4966	8.2225	8.4966	(231)
Lighting	15.3049	12.2782	11.0551	8.0995	6.2563	5.1114	5.7072	7.4184	9.6358	12.6427	14.2798	15.7303	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.5132	-17.8229	-30.3035	-40.1106	-47.0327	-44.4324	-44.1129	-38.8193	-31.3606	-21.9085	-12.4969	-9.0345	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.9320	-4.9322	-11.6309	-20.8679	-28.9016	-28.6057	-28.6546	-22.1822	-14.9388	-7.3952	-2.7906	-1.5349	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	23.1277	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2164.2989	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	100.0410	(230a)
Total electricity for the above, kWh/year	100.0410	(231)
Electricity for lighting (calculated in Appendix L)	123.5196	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-522.3147	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1888.6724	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	23.1277	25.1600	5.8189	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	25.1600	544.5376	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	100.0410	25.1600	25.1703	(249)
Energy for lighting	123.5196	25.1600	31.0775	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.9481	25.1600	-87.5437	
PV Unit electricity exported	-174.3666	5.8100	-10.1307	
Total			-97.6744	(252)
Total energy cost			508.9299	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	23.1277	0.1605	3.7119	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2164.2989	0.1413	305.7097	(264)
Space and water heating			309.4216	(265)
Pumps, fans and electric keep-hot	100.0410	0.1387	13.8769	(267)
Energy for lighting	123.5196	0.1443	17.8277	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.9481	0.1319	-45.8873	
PV Unit electricity exported	-174.3666	0.1230	-21.4415	
Total			-67.3287	(269)
Total CO2, kg/year			273.7975	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	23.1277	1.5940	36.8655	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	1.5223	3294.7406	(278)
Space and water heating			3331.6060	(279)
Pumps, fans and electric keep-hot	100.0410	1.5128	151.3420	(281)
Energy for lighting	123.5196	1.5338	189.4585	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.9481	1.4873	-517.4882	
PV Unit electricity exported	-174.3666	0.4513	-78.6896	
Total			-596.1778	(283)
Total Primary energy kWh/year			3076.2287	(286)

SAP 10 EPC IMPROVEMENTS

Unit 422 L02_Copy

Current energy efficiency rating: C 79
Current environmental impact rating: A 96

N Solar water heating — Not applicable
U Solar photovoltaic panels — Not applicable
V2 Wind turbine — Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 79
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£607	£607	£0
Space heating	£31	£31	£0
Water heating	£545	£545	£0
Lighting	£31	£31	£0
Generated (PV)	-£98	-£98	£0
Total cost of fuels	£509	£509	£0
Total cost of uses	£509	£509	£0
Delivered energy	39 kWh/m²	39 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	63 kWh/m²	63 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.8100 (1b)	x	2.4000 (2b)	=	117.1440	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.8100					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	117.1440	(5)

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2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.2900	1.2357	7.7728			(27)
External Wall 1	14.1700	6.2900	7.8800	0.1400	1.1032	14.0000	110.3200	(29a)
Total net area of external elements Aum(A, m2)			14.1700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		8.8760			(33)
Party Wall 1			24.8400	0.0000	0.0000	20.0000	496.8000	(32)
Wall to corridor			39.0100	0.0000	0.0000	20.0000	780.2000	(32)
Party Floor 1			48.8100			80.0000	3904.8000	(32d)
Party Ceiling 1			48.8100			80.0000	3904.8000	(32b)
Internal Wall 1			72.6800			9.0000	654.1200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9851.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		201.8242 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	1.8200	0.0500	0.0910
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.2500	0.0700	0.3675
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	20.8400	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.2465 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	10.1225 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.1418	11.0295	10.9171	10.3554	10.2430	9.6813	9.6813	9.5689	9.9060	10.2430	10.4677	10.6924	(38)
Heat transfer coeff	21.2643	21.1520	21.0396	20.4779	20.3655	19.8038	19.8038	19.6915	20.0285	20.3655	20.5902	20.8149	(39)
Average = Sum(39)m / 12 =												20.4498	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4357	0.4334	0.4311	0.4195	0.4172	0.4057	0.4057	0.4034	0.4103	0.4172	0.4218	0.4264	(40)
HLP (average)												0.4190	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.6551 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
71.4595	70.3856	68.8207	65.8266	63.6170	61.1529	59.7523	61.3053	63.0077	65.6534	68.7119	71.1857	(42a)

Hot water usage for baths

22.4723	22.1385	21.6685	20.8020	20.1531	19.4336	19.0450	19.5117	20.0198	20.7897	21.6741	22.3963	(42b)

Hot water usage for other uses

31.5802	30.4318	29.2834	28.1350	26.9867	25.8383	25.8383	26.9867	28.1350	29.2834	30.4318	31.5802	(42c)

Average daily hot water use (litres/day)		115.4278 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	125.5119	122.9558	119.7726	114.7636	110.7568	106.4248	104.6356	107.8037	111.1626	115.7265	120.8177	125.1621	(44)
Energy conte	198.7801	175.0875	184.0861	157.1056	149.0999	130.8617	126.5476	133.4834	137.0746	157.0398	172.1270	195.9736	(45)
Energy content (annual)										Total = Sum(45)m =		1917.2669	
Distribution loss (46)m = 0.15 x (45)m	29.8170	26.2631	27.6129	23.5658	22.3650	19.6293	18.9821	20.0225	20.5612	23.5560	25.8191	29.3960	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
										Total per year (kWh/year) = Sum(64)m =		2164.2989	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	82.8790	73.3769	77.9933	68.4808	66.3603	59.7547	58.8617	61.1679	61.8205	69.0004	73.4754	81.9459	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.4855	15.5304	12.6302	9.5619	7.1476	6.0343	6.5203	8.4753	11.3756	14.4439	16.8582	17.9715	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.1398	217.3723	211.7465	199.7699	184.6516	170.4425	160.9500	158.7175	164.3433	176.3199	191.4382	205.6473	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	(71)
Water heating gains (Table 5)	111.3965	109.1918	104.8296	95.1122	89.1940	82.9927	79.1152	82.2149	85.8618	92.7424	102.0492	110.1423	(72)
Total internal gains	423.7103	421.7830	408.8948	384.1325	360.6817	339.1579	326.2739	329.0962	341.2691	363.1946	390.0340	413.4494	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.2900	11.2829	0.6300	0.8270	0.7700	25.6243	(75)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	25.6243	52.1590	93.9740	154.3323	207.4529	221.1667	206.8969	164.9406	114.5088	63.7425	32.2420	20.9261	(83)
Total gains	449.3346	473.9420	502.8688	538.4647	568.1345	560.3246	533.1709	494.0368	455.7778	426.9371	422.2760	434.3755	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000	(85)

Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	128.6850	129.3685	130.0593	133.6270	134.3642	138.1755	138.1755	138.9638	136.6253	134.3642	132.8979	131.4633	
alpha	9.5790	9.6246	9.6706	9.9085	9.9576	10.2117	10.2117	10.2643	10.1084	9.9576	9.8599	9.7642	
util living area	0.7713	0.7099	0.6048	0.4601	0.3334	0.2262	0.1634	0.1833	0.3032	0.4959	0.6730	0.7841	(86)
MIT	20.9739	20.9874	20.9971	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9997	20.9938	20.9721	(87)
Th 2	20.5802	20.5823	20.5844	20.5951	20.5973	20.6080	20.6080	20.6101	20.6037	20.5973	20.5930	20.5887	(88)
util rest of house	0.7549	0.6930	0.5878	0.4447	0.3189	0.2123	0.1489	0.1678	0.2858	0.4767	0.6543	0.7681	(89)
MIT 2	20.5528	20.5694	20.5815	20.5950	20.5973	20.6080	20.6080	20.6101	20.6037	20.5970	20.5869	20.5593	(90)
Living area fraction										fLA = Living area / (4) =		0.5530	(91)
MIT	20.7856	20.8006	20.8113	20.8188	20.8200	20.8248	20.8248	20.8257	20.8228	20.8197	20.8119	20.7876	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7856	20.8006	20.8113	20.8188	20.8200	20.8248	20.8248	20.8257	20.8228	20.8197	20.8119	20.7876	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7630	0.7018	0.5971	0.4532	0.3269	0.2200	0.1569	0.1764	0.2954	0.4873	0.6644	0.7759	(94)
Useful gains	342.8519	332.6341	300.2537	244.0199	185.7311	123.2738	83.6662	87.1488	134.6479	208.0459	280.5415	337.0476	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	350.5562	336.3282	301.1047	244.0725	185.7329	123.2738	83.6662	87.1488	134.6483	208.1293	282.3311	345.2694	(97)
Space heating kWh	5.7320	2.4825	0.6331	0.0378	0.0014	0.0000	0.0000	0.0000	0.0000	0.0620	1.2885	6.1170	(98a)
Space heating requirement - total per year (kWh/year)												16.3544	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	5.7320	2.4825	0.6331	0.0378	0.0014	0.0000	0.0000	0.0000	0.0000	0.0620	1.2885	6.1170	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												16.3544	
Space heating per m2										(98c) / (4) =		0.3351	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	5.7320	2.4825	0.6331	0.0378	0.0014	0.0000	0.0000	0.0000	0.0000	0.0620	1.2885	6.1170	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	5.7320	2.4825	0.6331	0.0378	0.0014	0.0000	0.0000	0.0000	0.0000	0.0620	1.2885	6.1170	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.4966	7.6744	8.4966	8.2225	8.4966	8.2225	8.4966	8.4966	8.2225	8.4966	8.2225	8.4966	(231)
Lighting	15.3049	12.2782	11.0551	8.0995	6.2563	5.1114	5.7072	7.4184	9.6358	12.6427	14.2798	15.7303	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.6121	-18.5297	-30.3050	-38.4595	-45.4028	-43.7828	-43.0940	-38.8073	-31.5720	-22.8789	-13.4503	-9.7803	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.2735	-5.2746	-11.6439	-19.3564	-27.0799	-27.8299	-27.4302	-22.1697	-15.1176	-7.9609	-3.1515	-1.7474	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	16.3544	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2164.2989	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	100.0410	(230a)
Total electricity for the above, kWh/year	100.0410	(231)
Electricity for lighting (calculated in Appendix L)	123.5196	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-518.7101	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1885.5037	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	16.3544	16.4900	2.6968	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	16.4900	356.8929	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	100.0410	16.4900	16.4968	(249)
Energy for lighting	123.5196	16.4900	20.3684	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.6746	16.4900	-57.3315	
PV Unit electricity exported	-171.0355	5.5900	-9.5609	
Total			-66.8924	(252)
Total energy cost			329.5624	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2647	(257)
SAP value		79.4990	
SAP rating (Section 12)		79	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	16.3544	0.1611	2.6341	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2164.2989	0.1413	305.7097	(264)
Space and water heating			308.3438	(265)
Pumps, fans and electric keep-hot	100.0410	0.1387	13.8769	(267)
Energy for lighting	123.5196	0.1443	17.8277	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.6746	0.1322	-45.9593	
PV Unit electricity exported	-171.0355	0.1234	-21.1140	
Total			-67.0734	(269)
Total CO2, kg/year			272.9750	(272)
CO2 emissions per m2			5.5900	(273)
EI value			96.1008	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.8100	(1b)	x 2.4000	(2b) =	117.1440	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.8100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		117.1440	(5)

2. Ventilation rate

m3 per hour

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery		
If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			6.2900	1.2357	7.7728			(27)
External Wall 1	14.1700	6.2900	7.8800	0.1400	1.1032	14.0000	110.3200	(29a)
Total net area of external elements Aum(A, m2)			14.1700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		8.8760			(33)
Party Wall 1			24.8400	0.0000	0.0000	20.0000	496.8000	(32)
Wall to corridor			39.0100	0.0000	0.0000	20.0000	780.2000	(32)
Party Floor 1			48.8100			80.0000	3904.8000	(32d)
Party Ceiling 1			48.8100			80.0000	3904.8000	(32b)
Internal Wall 1			72.6800			9.0000	654.1200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9851.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		201.8242 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	1.8200	0.0500	0.0910
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.2500	0.0700	0.3675
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	20.8400	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.2465 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	10.1225 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.2542	11.2542	11.0295	10.3554	10.2430	9.7936	9.5689	9.5689	10.0183	10.5801	10.8048	10.6924	(38)
Heat transfer coeff	21.3767	21.3767	21.1520	20.4779	20.3655	19.9162	19.6915	19.6915	20.1409	20.7026	20.9273	20.8149	(39)
Average = Sum(39)m / 12 =												20.5528	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4380	0.4380	0.4334	0.4195	0.4172	0.4080	0.4034	0.4034	0.4126	0.4241	0.4288	0.4264	(40)
HLP (average)												0.4211	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.6551	(42)

Hot water usage for mixer showers

71.4595	70.3856	68.8207	65.8266	63.6170	61.1529	59.7523	61.3053	63.0077	65.6534	68.7119	71.1857	(42a)

Hot water usage for baths

22.4723	22.1385	21.6685	20.8020	20.1531	19.4336	19.0450	19.5117	20.0198	20.7897	21.6741	22.3963	(42b)

Hot water usage for other uses

31.5802	30.4318	29.2834	28.1350	26.9867	25.8383	25.8383	26.9867	28.1350	29.2834	30.4318	31.5802	(42c)

Average daily hot water use (litres/day)	115.4278	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	125.5119	122.9558	119.7726	114.7636	110.7568	106.4248	104.6356	107.8037	111.1626	115.7265	120.8177	125.1621	(44)
Energy conte	198.7801	175.0875	184.0861	157.1056	149.0999	130.8617	126.5476	133.4834	137.0746	157.0398	172.1270	195.9736	(45)
Energy content (annual)										Total = Sum(45)m =		1917.2669	

Distribution loss (46)m = 0.15 x (45)m

29.8170	26.2631	27.6129	23.5658	22.3650	19.6293	18.9821	20.0225	20.5612	23.5560	25.8191	29.3960	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544 (64)
										Total per year (kWh/year) = Sum(64)m =		2164.2989 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						0.0000 (64a)
Heat gains from water heating, kWh/month												
	82.8790	73.3769	77.9933	68.4808	66.3603	59.7547	58.8617	61.1679	61.8205	69.0004	73.4754	81.9459 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	99.3076	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	17.4855	15.5304	12.6302	9.5619	7.1476	6.0343	6.5203	8.4753	11.3756	14.4439	16.8582	17.9715	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	215.1398	217.3723	211.7465	199.7699	184.6516	170.4425	160.9500	158.7175	164.3433	176.3199	191.4382	205.6473	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	46.5859	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	-66.2051	(71)
Water heating gains (Table 5)													
	111.3965	109.1918	104.8296	95.1122	89.1940	82.9927	79.1152	82.2149	85.8618	92.7424	102.0492	110.1423	(72)
Total internal gains													
	423.7103	421.7830	408.8948	384.1325	360.6817	339.1579	326.2739	329.0962	341.2691	363.1946	390.0340	413.4494	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.2900	10.0309	0.6300	0.8270	0.7700	22.7809	(75)

Solar gains	22.7809	49.3199	92.7016	160.6228	214.7931	223.1785	211.1088	162.9125	112.0170	59.8425	29.4243	19.0490	(83)
Total gains	446.4911	471.1029	501.5964	544.7552	575.4748	562.3364	537.3828	492.0087	453.2861	423.0371	419.4582	432.4984	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	128.0086	128.0086	129.3685	133.6270	134.3642	137.3960	138.9638	138.9638	135.8632	132.1767	130.7575	131.4633	
alpha	9.5339	9.5339	9.6246	9.9085	9.9576	10.1597	10.2643	10.2643	10.0575	9.8118	9.7172	9.7642	
util living area													
	0.7936	0.7440	0.6458	0.4922	0.3645	0.2763	0.2235	0.2481	0.3643	0.5523	0.7101	0.8055	(86)
MIT	20.9657	20.9801	20.9945	20.9996	21.0000	21.0000	21.0000	21.0000	21.0000	20.9990	20.9892	20.9641	(87)
Th 2	20.5780	20.5780	20.5823	20.5951	20.5973	20.6058	20.6101	20.6101	20.6016	20.5908	20.5866	20.5887	(88)
util rest of house													
	0.7777	0.7274	0.6290	0.4771	0.3502	0.2623	0.2092	0.2325	0.3466	0.5325	0.6913	0.7903	(89)
MIT 2	20.5416	20.5573	20.5767	20.5948	20.5973	20.6058	20.6101	20.6101	20.6015	20.5900	20.5758	20.5504	(90)
Living area fraction										fLA = Living area / (4) =		0.5530	(91)
MIT	20.7761	20.7911	20.8077	20.8186	20.8199	20.8238	20.8257	20.8257	20.8219	20.8162	20.8044	20.7791	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7761	20.7911	20.8077	20.8186	20.8199	20.8238	20.8257	20.8257	20.8219	20.8162	20.8044	20.7791	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7853	0.7358	0.6381	0.4854	0.3581	0.2700	0.2171	0.2412	0.3564	0.5434	0.7012	0.7974	(94)
Useful gains	350.6097	346.6573	320.0551	264.4405	206.0934	151.8365	116.6859	118.6550	161.5640	229.8661	294.1317	344.8822	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	360.7559	352.5253	321.6735	264.5466	206.0982	151.8367	116.6859	118.6551	161.5672	230.1336	297.2597	355.5011	(97)
Space heating kWh													
	7.5487	3.9433	1.2041	0.0764	0.0036	0.0000	0.0000	0.0000	0.0000	0.1990	2.2521	7.9005	(98a)
Space heating requirement - total per year (kWh/year)												23.1277	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	7.5487	3.9433	1.2041	0.0764	0.0036	0.0000	0.0000	0.0000	0.0000	0.1990	2.2521	7.9005	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												23.1277	
Space heating per m2											(98c) / (4) =	0.4738	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement												

	7.5487	3.9433	1.2041	0.0764	0.0036	0.0000	0.0000	0.0000	0.0000	0.1990	2.2521	7.9005 (98)
Space heating efficiency (main heating system 1)												
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)												
	7.5487	3.9433	1.2041	0.0764	0.0036	0.0000	0.0000	0.0000	0.0000	0.1990	2.2521	7.9005 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	219.7609	194.0379	205.0669	177.4096	170.0807	151.1657	147.5284	154.4642	157.3786	178.0206	192.4310	216.9544 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	8.4966	7.6744	8.4966	8.2225	8.4966	8.2225	8.4966	8.4966	8.2225	8.4966	8.2225	8.4966 (231)
Lighting	15.3049	12.2782	11.0551	8.0995	6.2563	5.1114	5.7072	7.4184	9.6358	12.6427	14.2798	15.7303 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-10.5132	-17.8229	-30.3035	-40.1106	-47.0327	-44.4324	-44.1129	-38.8193	-31.3606	-21.9085	-12.4969	-9.0345 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-1.9320	-4.9322	-11.6309	-20.8679	-28.9016	-28.6057	-28.6546	-22.1822	-14.9388	-7.3952	-2.7906	-1.5349 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	23.1277 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2164.2989 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	100.0410 (230a)
Total electricity for the above, kWh/year	100.0410 (231)
Electricity for lighting (calculated in Appendix L)	123.5196 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-522.3147 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1888.6724 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	23.1277	25.1600	5.8189	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	25.1600	544.5376	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	100.0410	25.1600	25.1703	(249)
Energy for lighting	123.5196	25.1600	31.0775	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.9481	25.1600	-87.5437	
PV Unit electricity exported	-174.3666	5.8100	-10.1307	
Total			-97.6744	(252)
Total energy cost			508.9299	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	23.1277	0.1605	3.7119	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2164.2989	0.1413	305.7097	(264)
Space and water heating			309.4216	(265)
Pumps, fans and electric keep-hot	100.0410	0.1387	13.8769	(267)
Energy for lighting	123.5196	0.1443	17.8277	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.9481	0.1319	-45.8873	
PV Unit electricity exported	-174.3666	0.1230	-21.4415	
Total			-67.3287	(269)
Total CO2, kg/year			273.7975	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year

Space heating - main system 1	23.1277	1.5940	36.8655	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2164.2989	1.5223	3294.7406	(278)
Space and water heating			3331.6060	(279)
Pumps, fans and electric keep-hot	100.0410	1.5128	151.3420	(281)
Energy for lighting	123.5196	1.5338	189.4585	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.9481	1.4873	-517.4882	
PV Unit electricity exported	-174.3666	0.4513	-78.6896	
Total			-596.1778	(283)
Total Primary energy kWh/year			3076.2287	(286)

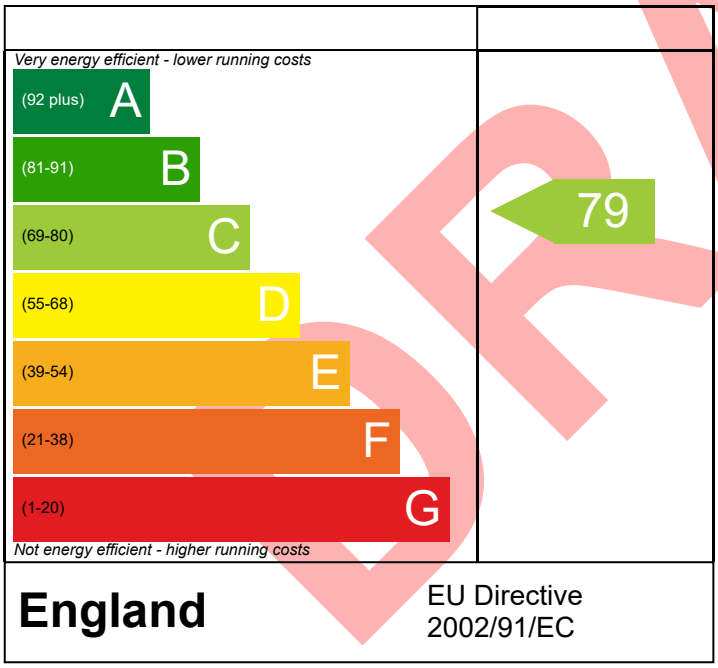
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	48.81 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

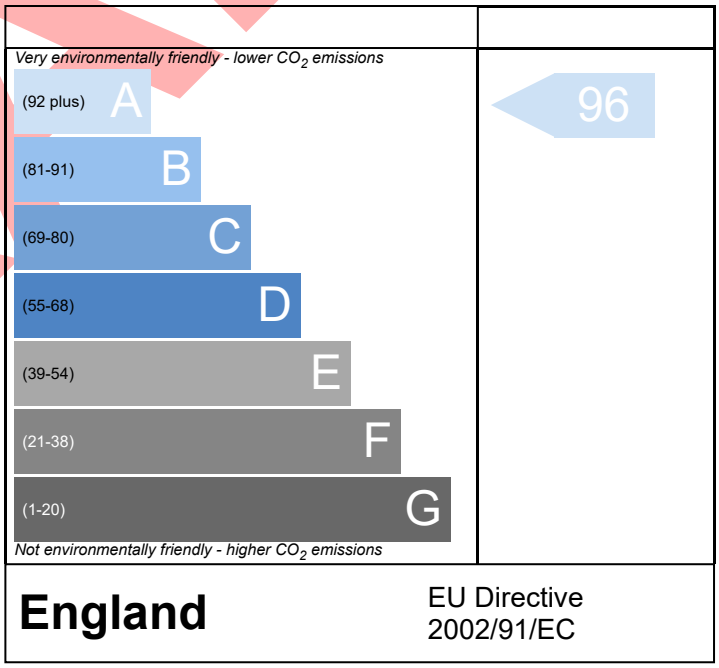
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:32

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	51 m^2
Site Reference	Unit 423 L02_Copy	Plot Reference	Unit 423 L02_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.09 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	5.38 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*60.3 kWh_{PE}/m^2*	
Dwelling primary energy	60.59 kWh_{PE}/m^2	FAIL
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*12.7 kWh/m^2*	
Dwelling fabric energy efficiency	11.8 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	7.91	0.14 **(!)**
Party wall: Party Wall (1)	47.52	0 **(!)**
Party wall: Party Wall (2)	15.79	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SE, Opening Type 1	7.88	South East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.67 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 423 L02_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 423 L02_Copy	**Prop Type Ref**	Unit 423 L02
Property			

SAP Rating	80 C	**DER**	5.38	**TER**	11.09
Environmental	96 A	**% DER < TER**			51.49
CO_2 Emissions (t/year)	0.28	**DFEE**	11.77	**TFEE**	12.71
Compliance Check	See BREL	**% DFEE < TFEE**			7.41
% DPER < TPER	-0.48	**DPER**	60.59	**TPER**	60.30

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.4800	(1b)	x 2.4000	(2b) =	123.5520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.4800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		123.5520	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												72.0000	(23c)
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	15.7900	7.8800	7.9100	0.1400	1.1074	14.0000	110.7400	(29a)
Total net area of external elements Aum(A, m2)			15.7900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.8450			(33)
Party Wall 1			47.5200	0.0000	0.0000	20.0000	950.4000	(32)
Wall to corridor			15.7900	0.0000	0.0000	20.0000	315.8000	(32)
Party Floor 1			51.4800			80.0000	4118.4000	(32d)
Party Ceiling 1			51.4800			80.0000	4118.4000	(32b)
Internal Wall 1			80.1900			9.0000	721.7100	(32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		10335.4500	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							200.7663	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695

E4 Jamb	9.2800	0.0500	0.4640	
E7 Party floor between dwellings (in blocks of flats)	5.8500	0.0700	0.4095	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.4500	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.3670 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 12.2120 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.7513	11.6328	11.5143	10.9218	10.8033	10.2109	10.2109	10.0924	10.4479	10.8033	11.0403	11.2773	(38)
Heat transfer coeff	23.9633	23.8448	23.7264	23.1339	23.0154	22.4229	22.4229	22.3044	22.6599	23.0154	23.2524	23.4894	(39)

Average = Sum(39)m / 12 = 23.1043

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4655	0.4632	0.4609	0.4494	0.4471	0.4356	0.4356	0.4333	0.4402	0.4471	0.4517	0.4563	(40)
HLP (average)												0.4488	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7337 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.2716	72.1705	70.5659	67.4959	65.2303	62.7037	61.2676	62.8600	64.6056	67.3184	70.4543	72.9909	(42a)
Hot water usage for baths	23.0390	22.6968	22.2150	21.3266	20.6614	19.9237	19.5253	20.0037	20.5247	21.3140	22.2207	22.9611	(42b)
Hot water usage for other uses	32.3851	31.2075	30.0298	28.8522	27.6746	26.4969	26.4969	27.6746	28.8522	30.0298	31.2075	32.3851	(42c)

Average daily hot water use (litres/day) 118.3558 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.6957	126.0748	122.8108	117.6747	113.5662	109.1243	107.2898	110.5383	113.9825	118.6622	123.8825	128.3371	(44)
Energy conte	203.8226	179.5288	188.7556	161.0907	152.8819	134.1811	129.7577	136.8695	140.5518	161.0235	176.4934	200.9449	(45)

Energy content (annual) Total = Sum(45)m = 1965.9015

Distribution loss (46)m = 0.15 x (45)m	30.5734	26.9293	28.3133	24.1636	22.9323	20.1272	19.4636	20.5304	21.0828	24.1535	26.4740	30.1417	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)

Total per year (kWh/year) = Sum(64)m = 2212.9335 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	84.5557	74.8537	79.5459	69.8059	67.6179	60.8584	59.9291	62.2937	62.9767	70.3250	74.9273	83.5988	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.7487	15.7643	12.8204	9.7058	7.2552	6.1252	6.6185	8.6029	11.5468	14.6613	17.1120	18.2420	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	225.4877	227.8276	221.9312	209.3786	193.5331	178.6406	168.6914	166.3516	172.2479	184.8006	200.6461	215.5386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	(71)
Water heating gains (Table 5)	113.6501	111.3894	106.9165	96.9526	90.8842	84.5256	80.5498	83.7281	87.4676	94.5228	104.0656	112.3640	(72)
Total internal gains	438.6972	436.7919	423.4788	397.8477	373.4832	351.1020	337.6704	340.4934	353.0731	375.7954	403.6344	427.9553	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(77)

Solar gains	104.6841	178.3157	243.9793	302.3022	338.6036	336.1550	324.0893	297.0068	264.1780	197.0768	125.3874	89.5877	(83)
Total gains	543.3813	615.1076	667.4580	700.1498	712.0869	687.2570	661.7597	637.5001	617.2510	572.8722	529.0217	517.5431	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	119.8063	120.4016	121.0029	124.1019	124.7408	128.0368	128.0368	128.7170	126.6977	124.7408	123.4694	122.2237	
alpha	8.9871	9.0268	9.0669	9.2735	9.3161	9.5358	9.5358	9.5811	9.4465	9.3161	9.2313	9.1482	
util living area													
	0.7234	0.6208	0.5148	0.3998	0.3006	0.2088	0.1491	0.1609	0.2533	0.4178	0.6084	0.7463	(86)
MIT	20.9795	20.9940	20.9988	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9999	20.9961	20.9757	(87)
Th 2	20.5526	20.5547	20.5568	20.5675	20.5696	20.5802	20.5802	20.5824	20.5760	20.5696	20.5653	20.5611	(88)
util rest of house													
	0.7062	0.6042	0.4992	0.3855	0.2867	0.1951	0.1349	0.1463	0.2377	0.4005	0.5899	0.7294	(89)
MIT 2	20.5313	20.5486	20.5557	20.5674	20.5696	20.5802	20.5802	20.5824	20.5760	20.5695	20.5615	20.5356	(90)
Living area fraction										fLA = Living area / (4) =		0.5577	(91)
MIT	20.7812	20.7970	20.8028	20.8086	20.8096	20.8143	20.8143	20.8153	20.8125	20.8095	20.8039	20.7811	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7812	20.7970	20.8028	20.8086	20.8096	20.8143	20.8143	20.8153	20.8125	20.8095	20.8039	20.7811	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7151	0.6132	0.5079	0.3934	0.2944	0.2028	0.1428	0.1545	0.2464	0.4101	0.6001	0.7379	(94)
Useful gains	388.5487	377.2072	338.9911	275.4626	209.6597	139.3436	94.4978	98.4804	152.1033	234.9415	317.4656	381.9023	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	394.9458	379.0622	339.3534	275.4919	209.6614	139.3436	94.4978	98.4804	152.1035	234.9759	318.6483	389.4786	(97)
Space heating kWh													
	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(98a)
Space heating requirement - total per year (kWh/year)												12.8118	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												12.8118	
Space heating per m2											(98c) / (4) =	0.2489	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9614	8.0942	8.9614	8.6723	8.9614	8.6723	8.9614	8.9614	8.6723	8.9614	8.6723	8.9614	(231)
Lighting	15.5353	12.4630	11.2216	8.2214	6.3505	5.1884	5.7931	7.5301	9.7808	12.8330	14.4948	15.9671	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.3128	-19.6230	-32.0667	-40.6524	-47.9480	-46.2189	-45.4896	-40.9865	-33.3753	-24.2196	-14.2561	-10.3736	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4545	-5.6926	-12.5456	-20.8344	-29.1368	-29.9406	-29.5123	-23.8619	-16.2788	-8.5783	-3.3998	-1.8860	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	12.8118	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2212.9335	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	105.5134	(230a)
Total electricity for the above, kWh/year	105.5134	(231)
Electricity for lighting (calculated in Appendix L)	125.3792	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-551.6441	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1904.9938	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	12.8118	16.4900	2.1127	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	16.4900	364.9127	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	105.5134	16.4900	17.3992	(249)
Energy for lighting	125.3792	16.4900	20.6750	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.5224	16.4900	-60.6044	
PV Unit electricity exported	-184.1216	5.5900	-10.2924	
Total			-70.8968	(252)
Total energy cost			334.2027	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2470	(257)
SAP value		79.7857	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	12.8118	0.1616	2.0705	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2212.9335	0.1413	312.5953	(264)
Space and water heating			314.6658	(265)
Pumps, fans and electric keep-hot	105.5134	0.1387	14.6360	(267)
Energy for lighting	125.3792	0.1443	18.0961	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.5224	0.1322	-48.5906	
PV Unit electricity exported	-184.1216	0.1235	-22.7330	
Total			-71.3237	(269)
Total CO2, kg/year			276.0743	(272)
CO2 emissions per m2			5.3600	(273)
EI value			96.1656	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		51.4800 (1b)	x	2.4000 (2b)	=	123.5520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.4800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	123.5520	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	15.7900	7.8800	7.9100	0.1400	1.1074	14.0000	110.7400	(29a)
Total net area of external elements Aum(A, m2)			15.7900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.8450			(33)
Party Wall 1			47.5200	0.0000	0.0000	20.0000	950.4000	(32)
Wall to corridor			15.7900	0.0000	0.0000	20.0000	315.8000	(32)
Party Floor 1			51.4800			80.0000	4118.4000	(32d)
Party Ceiling 1			51.4800			80.0000	4118.4000	(32b)
Internal Wall 1			80.1900			9.0000	721.7100	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 10335.4500 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 200.7663 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.8500	0.0700	0.4095
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.4500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.3670 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 12.2120 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.8698	11.8698	11.6328	10.9218	10.8033	10.3294	10.0924	10.0924	10.5664	11.1588	11.3958	11.2773	(38)
Heat transfer coeff	24.0818	24.0818	23.8448	23.1339	23.0154	22.5414	22.3044	22.3044	22.7784	23.3709	23.6079	23.4894	(39)

Average = Sum(39)m / 12 = 23.2129

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4678	0.4678	0.4632	0.4494	0.4471	0.4379	0.4333	0.4333	0.4425	0.4540	0.4586	0.4563	(40)
HLP (average)												0.4509	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7337 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.2716	72.1705	70.5659	67.4959	65.2303	62.7037	61.2676	62.8600	64.6056	67.3184	70.4543	72.9909	(42a)
Hot water usage for baths	23.0390	22.6968	22.2150	21.3266	20.6614	19.9237	19.5253	20.0037	20.5247	21.3140	22.2207	22.9611	(42b)
Hot water usage for other uses	32.3851	31.2075	30.0298	28.8522	27.6746	26.4969	26.4969	27.6746	28.8522	30.0298	31.2075	32.3851	(42c)

Average daily hot water use (litres/day) 118.3558 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.6957	126.0748	122.8108	117.6747	113.5662	109.1243	107.2898	110.5383	113.9825	118.6622	123.8825	128.3371	(44)
Energy conte	203.8226	179.5288	188.7556	161.0907	152.8819	134.1811	129.7577	136.8695	140.5518	161.0235	176.4934	200.9449	(45)
Energy content (annual)										Total = Sum(45)m =		1965.9015	
Distribution loss (46)m = 0.15 x (45)m	30.5734	26.9293	28.3133	24.1636	22.9323	20.1272	19.4636	20.5304	21.0828	24.1535	26.4740	30.1417	(46)

Water storage loss:

Store volume 143.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)

Temperature factor from Table 2b 0.6000 (49)

Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
										Total per year (kWh/year) = Sum(64)m =		2212.9335	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	84.5557	74.8537	79.5459	69.8059	67.6179	60.8584	59.9291	62.2937	62.9767	70.3250	74.9273	83.5988	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	17.7487	15.7643	12.8204	9.7058	7.2552	6.1252	6.6185	8.6029	11.5468	14.6613	17.1120	18.2420	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	225.4877	227.8276	221.9312	209.3786	193.5331	178.6406	168.6914	166.3516	172.2479	184.8006	200.6461	215.5386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	(71)
Water heating gains (Table 5)													
	113.6501	111.3894	106.9165	96.9526	90.8842	84.5256	80.5498	83.7281	87.4676	94.5228	104.0656	112.3640	(72)
Total internal gains													
	438.6972	436.7919	423.4788	397.8477	373.4832	351.1020	337.6704	340.4934	353.0731	375.7954	403.6344	427.9553	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(77)

Solar gains	95.2051	173.0844	247.4999	322.5774	357.6553	345.0938	336.8383	300.1802	265.5901	190.1488	117.1921	83.3220	(83)
Total gains	533.9023	609.8763	670.9786	720.4250	731.1385	696.1958	674.5087	640.6735	618.6632	565.9442	520.8265	511.2773	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	119.2167	119.2167	120.4016	124.1019	124.7408	127.3637	128.7170	128.7170	126.0386	122.8434	121.6103	122.2237	
alpha	8.9478	8.9478	9.0268	9.2735	9.3161	9.4909	9.5811	9.5811	9.4026	9.1896	9.1074	9.1482	
util living area													
	0.7526	0.6539	0.5462	0.4206	0.3242	0.2525	0.2017	0.2158	0.3019	0.4664	0.6480	0.7727	(86)
MIT	20.9712	20.9903	20.9979	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9996	20.9929	20.9672	(87)
Th 2	20.5504	20.5504	20.5547	20.5675	20.5696	20.5781	20.5824	20.5824	20.5738	20.5632	20.5589	20.5611	(88)
util rest of house													
	0.7357	0.6373	0.5306	0.4067	0.3107	0.2389	0.1879	0.2013	0.2862	0.4484	0.6291	0.7564	(89)
MIT 2	20.5201	20.5405	20.5526	20.5673	20.5696	20.5781	20.5824	20.5824	20.5738	20.5629	20.5519	20.5263	(90)
Living area fraction										fLA = Living area / (4) =		0.5577	(91)
MIT	20.7716	20.7914	20.8010	20.8085	20.8096	20.8134	20.8153	20.8153	20.8115	20.8064	20.7978	20.7722	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7716	20.7914	20.8010	20.8085	20.8096	20.8134	20.8153	20.8153	20.8115	20.8064	20.7978	20.7722	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7441	0.6462	0.5392	0.4144	0.3182	0.2465	0.1956	0.2094	0.2950	0.4585	0.6394	0.7643	(94)
Useful gains	397.2723	394.1170	361.8210	298.5746	232.6729	171.6165	131.9370	134.1674	182.4879	259.4584	332.9973	390.7730	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	406.3003	397.1421	362.4645	298.6242	232.6766	171.6167	131.9370	134.1674	182.4893	259.5673	335.1804	401.0157	(97)
Space heating kWh													
	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205	(98a)
Space heating requirement - total per year (kWh/year)												18.5404	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												18.5404	
Space heating per m2										(98c) / (4) =		0.3601	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9614	8.0942	8.9614	8.6723	8.9614	8.6723	8.9614	8.9614	8.6723	8.9614	8.6723	8.9614	(231)

Lighting	15.5353	12.4630	11.2216	8.2214	6.3505	5.1884	5.7931	7.5301	9.7808	12.8330	14.4948	15.9671 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-11.1496	-18.8721	-32.0603	-42.3899	-49.6609	-46.9012	-46.5595	-40.9992	-33.1527	-23.1943	-13.2464	-9.5840 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.0858	-5.3278	-12.5367	-22.4603	-31.0947	-30.7742	-30.8282	-23.8754	-16.0865	-7.9699	-3.0116	-1.6564 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	18.5404 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2212.9335 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	105.5134 (230a)
Total electricity for the above, kWh/year	105.5134 (231)
Electricity for lighting (calculated in Appendix L)	125.3792 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-555.4776 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1906.8888 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	18.5404	25.1600	4.6648	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	25.1600	556.7741	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	105.5134	25.1600	26.5472	(249)
Energy for lighting	125.3792	25.1600	31.5454	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.7700	25.1600	-92.5309	
PV Unit electricity exported	-187.7076	5.8100	-10.9058	
Total			-103.4367	(252)
Total energy cost			516.0946	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	18.5404	0.1612	2.9893	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2212.9335	0.1413	312.5953	(264)
Space and water heating			315.5847	(265)
Pumps, fans and electric keep-hot	105.5134	0.1387	14.6360	(267)
Energy for lighting	125.3792	0.1443	18.0961	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.7700	0.1319	-48.5087	
PV Unit electricity exported	-187.7076	0.1230	-23.0860	
Total			-71.5947	(269)
Total CO2, kg/year			276.7220	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	18.5404	1.5966	29.6024	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	1.5223	3368.8373	(278)
Space and water heating			3398.4396	(279)
Pumps, fans and electric keep-hot	105.5134	1.5128	159.6207	(281)
Energy for lighting	125.3792	1.5338	192.3107	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.7700	1.4873	-546.9961	
PV Unit electricity exported	-187.7076	0.4514	-84.7250	
Total			-631.7212	(283)
Total Primary energy kWh/year			3118.6499	(286)

SAP 10 EPC IMPROVEMENTS

Unit 423 L02_Copy

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 80
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£620	£620	£0
Space heating	£31	£31	£0
Water heating	£557	£557	£0
Lighting	£32	£32	£0
Generated (PV)	-£103	-£103	£0
Total cost of fuels	£517	£517	£0
Total cost of uses	£517	£517	£0
Delivered energy	37 kWh/m²	37 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	61 kWh/m²	61 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.4800 (1b)	x	2.4000 (2b)	=	123.5520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.4800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	123.5520	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	15.7900	7.8800	7.9100	0.1400	1.1074	14.0000	110.7400	(29a)
Total net area of external elements Aum(A, m2)			15.7900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	10.8450			(33)
Party Wall 1			47.5200	0.0000	0.0000	20.0000	950.4000	(32)
Wall to corridor			15.7900	0.0000	0.0000	20.0000	315.8000	(32)
Party Floor 1			51.4800			80.0000	4118.4000	(32d)
Party Ceiling 1			51.4800			80.0000	4118.4000	(32b)
Internal Wall 1			80.1900			9.0000	721.7100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10335.4500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		200.7663 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.8500	0.0700	0.4095
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.4500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.3670 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	12.2120 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.7513	11.6328	11.5143	10.9218	10.8033	10.2109	10.2109	10.0924	10.4479	10.8033	11.0403	11.2773	(38)
Heat transfer coeff	23.9633	23.8448	23.7264	23.1339	23.0154	22.4229	22.4229	22.3044	22.6599	23.0154	23.2524	23.4894	(39)
Average = Sum(39)m / 12 =												23.1043	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4655	0.4632	0.4609	0.4494	0.4471	0.4356	0.4356	0.4333	0.4402	0.4471	0.4517	0.4563	(40)
HLP (average)												0.4488	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7337	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.2716	72.1705	70.5659	67.4959	65.2303	62.7037	61.2676	62.8600	64.6056	67.3184	70.4543	72.9909	(42a)

Hot water usage for baths

23.0390	22.6968	22.2150	21.3266	20.6614	19.9237	19.5253	20.0037	20.5247	21.3140	22.2207	22.9611	(42b)

Hot water usage for other uses

32.3851	31.2075	30.0298	28.8522	27.6746	26.4969	26.4969	27.6746	28.8522	30.0298	31.2075	32.3851	(42c)

Average daily hot water use (litres/day)	118.3558	(43)

Daily hot water use

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
128.6957	126.0748	122.8108	117.6747	113.5662	109.1243	107.2898	110.5383	113.9825	118.6622	123.8825	128.3371	(44)
Energy conte 203.8226	179.5288	188.7556	161.0907	152.8819	134.1811	129.7577	136.8695	140.5518	161.0235	176.4934	200.9449	(45)

Energy content (annual)	Total = Sum(45)m =	1965.9015

Distribution loss (46)m = 0.15 x (45)m

30.5734	26.9293	28.3133	24.1636	22.9323	20.1272	19.4636	20.5304	21.0828	24.1535	26.4740	30.1417	(46)

Water storage loss:		
Store volume	143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280	(48)
Temperature factor from Table 2b	0.6000	(49)
Enter (49) or (54) in (55)	0.6768	(55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)

Total per year (kWh/year) = Sum(64)m =	2212.9335	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000	(64a)

Heat gains from water heating, kWh/month

84.5557	74.8537	79.5459	69.8059	67.6179	60.8584	59.9291	62.2937	62.9767	70.3250	74.9273	83.5988	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.7487	15.7643	12.8204	9.7058	7.2552	6.1252	6.6185	8.6029	11.5468	14.6613	17.1120	18.2420	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	225.4877	227.8276	221.9312	209.3786	193.5331	178.6406	168.6914	166.3516	172.2479	184.8006	200.6461	215.5386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	(71)
Water heating gains (Table 5)	113.6501	111.3894	106.9165	96.9526	90.8842	84.5256	80.5498	83.7281	87.4676	94.5228	104.0656	112.3640	(72)
Total internal gains	438.6972	436.7919	423.4788	397.8477	373.4832	351.1020	337.6704	340.4934	353.0731	375.7954	403.6344	427.9553	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(77)

Solar gains	104.6841	178.3157	243.9793	302.3022	338.6036	336.1550	324.0893	297.0068	264.1780	197.0768	125.3874	89.5877 (83)
Total gains	543.3813	615.1076	667.4580	700.1498	712.0869	687.2570	661.7597	637.5001	617.2510	572.8722	529.0217	517.5431 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	119.8063	120.4016	121.0029	124.1019	124.7408	128.0368	128.0368	128.7170	126.6977	124.7408	123.4694	122.2237	
alpha	8.9871	9.0268	9.0669	9.2735	9.3161	9.5358	9.5358	9.5811	9.4465	9.3161	9.2313	9.1482	
util living area	0.7234	0.6208	0.5148	0.3998	0.3006	0.2088	0.1491	0.1609	0.2533	0.4178	0.6084	0.7463	(86)
MIT	20.9795	20.9940	20.9988	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9999	20.9961	20.9757	(87)
Th 2	20.5526	20.5547	20.5568	20.5675	20.5696	20.5802	20.5802	20.5824	20.5760	20.5696	20.5653	20.5611	(88)
util rest of house	0.7062	0.6042	0.4992	0.3855	0.2867	0.1951	0.1349	0.1463	0.2377	0.4005	0.5899	0.7294	(89)
MIT 2	20.5313	20.5486	20.5557	20.5674	20.5696	20.5802	20.5802	20.5824	20.5760	20.5695	20.5615	20.5356	(90)
Living area fraction									fLA = Living area / (4) =			0.5577	(91)
MIT	20.7812	20.7970	20.8028	20.8086	20.8096	20.8143	20.8143	20.8153	20.8125	20.8095	20.8039	20.7811	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7812	20.7970	20.8028	20.8086	20.8096	20.8143	20.8143	20.8153	20.8125	20.8095	20.8039	20.7811	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7151	0.6132	0.5079	0.3934	0.2944	0.2028	0.1428	0.1545	0.2464	0.4101	0.6001	0.7379	(94)
Useful gains	388.5487	377.2072	338.9911	275.4626	209.6597	139.3436	94.4978	98.4804	152.1033	234.9415	317.4656	381.9023	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	394.9458	379.0622	339.3534	275.4919	209.6614	139.3436	94.4978	98.4804	152.1035	234.9759	318.6483	389.4786	(97)
Space heating kWh	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(98a)
Space heating requirement - total per year (kWh/year)												12.8118	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												12.8118	
Space heating per m2											(98c) / (4) =	0.2489	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	4.7594	1.2466	0.2696	0.0211	0.0012	0.0000	0.0000	0.0000	0.0000	0.0256	0.8516	5.6368	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9614	8.0942	8.9614	8.6723	8.9614	8.6723	8.9614	8.9614	8.6723	8.9614	8.6723	8.9614	(231)
Lighting	15.5353	12.4630	11.2216	8.2214	6.3505	5.1884	5.7931	7.5301	9.7808	12.8330	14.4948	15.9671	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.3128	-19.6230	-32.0667	-40.6524	-47.9480	-46.2189	-45.4896	-40.9865	-33.3753	-24.2196	-14.2561	-10.3736	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4545	-5.6926	-12.5456	-20.8344	-29.1368	-29.9406	-29.5123	-23.8619	-16.2788	-8.5783	-3.3998	-1.8860	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												12.8118	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2212.9335	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	105.5134	(230a)
Total electricity for the above, kWh/year	105.5134	(231)
Electricity for lighting (calculated in Appendix L)	125.3792	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-551.6441	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1904.9938	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	12.8118	16.4900	2.1127	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	16.4900	364.9127	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	105.5134	16.4900	17.3992	(249)
Energy for lighting	125.3792	16.4900	20.6750	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.5224	16.4900	-60.6044	
PV Unit electricity exported	-184.1216	5.5900	-10.2924	
Total			-70.8968	(252)
Total energy cost			334.2027	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.2470	(257)
SAP value	79.7857	
SAP rating (Section 12)	80	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	12.8118	0.1616	2.0705	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2212.9335	0.1413	312.5953	(264)
Space and water heating			314.6658	(265)
Pumps, fans and electric keep-hot	105.5134	0.1387	14.6360	(267)
Energy for lighting	125.3792	0.1443	18.0961	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.5224	0.1322	-48.5906	
PV Unit electricity exported	-184.1216	0.1235	-22.7330	
Total			-71.3237	(269)
Total CO2, kg/year			276.0743	(272)
CO2 emissions per m2			5.3600	(273)
EI value			96.1656	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.4800	(1b)	x 2.4000	(2b) =	123.5520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 51.4800						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		123.5520	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 = 0.0000	(6a)
Number of open flues	0 * 20 = 0.0000	(6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	15.7900	7.8800	7.9100	0.1400	1.1074	14.0000	110.7400	(29a)
Total net area of external elements Aum(A, m2)			15.7900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	10.8450			(33)
Party Wall 1			47.5200	0.0000	0.0000	20.0000	950.4000	(32)
Wall to corridor			15.7900	0.0000	0.0000	20.0000	315.8000	(32)
Party Floor 1			51.4800			80.0000	4118.4000	(32d)
Party Ceiling 1			51.4800			80.0000	4118.4000	(32b)
Internal Wall 1			80.1900			9.0000	721.7100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10335.4500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		200.7663 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.8500	0.0700	0.4095
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.4500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.3670 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	12.2120 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.8698	11.8698	11.6328	10.9218	10.8033	10.3294	10.0924	10.0924	10.5664	11.1588	11.3958	11.2773	(38)
Heat transfer coeff	24.0818	24.0818	23.8448	23.1339	23.0154	22.5414	22.3044	22.3044	22.7784	23.3709	23.6079	23.4894	(39)
Average = Sum(39)m / 12 =												23.2129	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4678	0.4678	0.4632	0.4494	0.4471	0.4379	0.4333	0.4333	0.4425	0.4540	0.4586	0.4563	(40)
HLP (average)												0.4509	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.7337 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.2716	72.1705	70.5659	67.4959	65.2303	62.7037	61.2676	62.8600	64.6056	67.3184	70.4543	72.9909	(42a)

Hot water usage for baths

23.0390	22.6968	22.2150	21.3266	20.6614	19.9237	19.5253	20.0037	20.5247	21.3140	22.2207	22.9611	(42b)

Hot water usage for other uses

32.3851	31.2075	30.0298	28.8522	27.6746	26.4969	26.4969	27.6746	28.8522	30.0298	31.2075	32.3851	(42c)

Average daily hot water use (litres/day)		118.3558 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.6957	126.0748	122.8108	117.6747	113.5662	109.1243	107.2898	110.5383	113.9825	118.6622	123.8825	128.3371	(44)
Energy conte	203.8226	179.5288	188.7556	161.0907	152.8819	134.1811	129.7577	136.8695	140.5518	161.0235	176.4934	200.9449	(45)
Energy content (annual)										Total = Sum(45)m =		1965.9015	

Distribution loss (46)m = 0.15 x (45)m

30.5734	26.9293	28.3133	24.1636	22.9323	20.1272	19.4636	20.5304	21.0828	24.1535	26.4740	30.1417	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257	(64)
										Total per year (kWh/year) = Sum(64)m =		2212.9335	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	84.5557	74.8537	79.5459	69.8059	67.6179	60.8584	59.9291	62.2937	62.9767	70.3250	74.9273	83.5988	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	104.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.7487	15.7643	12.8204	9.7058	7.2552	6.1252	6.6185	8.6029	11.5468	14.6613	17.1120	18.2420	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	225.4877	227.8276	221.9312	209.3786	193.5331	178.6406	168.6914	166.3516	172.2479	184.8006	200.6461	215.5386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	47.1361	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	-69.3492	(71)
Water heating gains (Table 5)	113.6501	111.3894	106.9165	96.9526	90.8842	84.5256	80.5498	83.7281	87.4676	94.5228	104.0656	112.3640	(72)
Total internal gains	438.6972	436.7919	423.4788	397.8477	373.4832	351.1020	337.6704	340.4934	353.0731	375.7954	403.6344	427.9553	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(77)

Solar gains	95.2051	173.0844	247.4999	322.5774	357.6553	345.0938	336.8383	300.1802	265.5901	190.1488	117.1921	83.3220	(83)
Total gains	533.9023	609.8763	670.9786	720.4250	731.1385	696.1958	674.5087	640.6735	618.6632	565.9442	520.8265	511.2773	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	119.2167	119.2167	120.4016	124.1019	124.7408	127.3637	128.7170	128.7170	126.0386	122.8434	121.6103	122.2237	
alpha	8.9478	8.9478	9.0268	9.2735	9.3161	9.4909	9.5811	9.5811	9.4026	9.1896	9.1074	9.1482	
util living area	0.7526	0.6539	0.5462	0.4206	0.3242	0.2525	0.2017	0.2158	0.3019	0.4664	0.6480	0.7727	(86)
MIT	20.9712	20.9903	20.9979	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9996	20.9929	20.9672	(87)
Th 2	20.5504	20.5504	20.5547	20.5675	20.5696	20.5781	20.5824	20.5824	20.5738	20.5632	20.5589	20.5611	(88)
util rest of house	0.7357	0.6373	0.5306	0.4067	0.3107	0.2389	0.1879	0.2013	0.2862	0.4484	0.6291	0.7564	(89)
MIT 2	20.5201	20.5405	20.5526	20.5673	20.5696	20.5781	20.5824	20.5824	20.5738	20.5629	20.5519	20.5263	(90)
Living area fraction										fLA = Living area / (4) =		0.5577	(91)
MIT	20.7716	20.7914	20.8010	20.8085	20.8096	20.8134	20.8153	20.8153	20.8115	20.8064	20.7978	20.7722	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7716	20.7914	20.8010	20.8085	20.8096	20.8134	20.8153	20.8153	20.8115	20.8064	20.7978	20.7722	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7441	0.6462	0.5392	0.4144	0.3182	0.2465	0.1956	0.2094	0.2950	0.4585	0.6394	0.7643	(94)
Useful gains	397.2723	394.1170	361.8210	298.5746	232.6729	171.6165	131.9370	134.1674	182.4879	259.4584	332.9973	390.7730	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	406.3003	397.1421	362.4645	298.6242	232.6766	171.6167	131.9370	134.1674	182.4893	259.5673	335.1804	401.0157	(97)
Space heating kWh	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205	(98a)
Space heating requirement - total per year (kWh/year)												18.5404	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												18.5404	
Space heating per m2											(98c) / (4) =	0.3601	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													

	6.7169	2.0329	0.4788	0.0357	0.0028	0.0000	0.0000	0.0000	0.0000	0.0810	1.5718	7.6205 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	224.8034	198.4792	209.7364	181.3947	173.8627	154.4851	150.7385	157.8503	160.8558	182.0043	196.7974	221.9257 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	8.9614	8.0942	8.9614	8.6723	8.9614	8.6723	8.9614	8.9614	8.6723	8.9614	8.6723	8.9614 (231)
Lighting	15.5353	12.4630	11.2216	8.2214	6.3505	5.1884	5.7931	7.5301	9.7808	12.8330	14.4948	15.9671 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-11.1496	-18.8721	-32.0603	-42.3899	-49.6609	-46.9012	-46.5595	-40.9992	-33.1527	-23.1943	-13.2464	-9.5840 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.0858	-5.3278	-12.5367	-22.4603	-31.0947	-30.7742	-30.8282	-23.8754	-16.0865	-7.9699	-3.0116	-1.6564 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	18.5404 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2212.9335 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	105.5134 (230a)
Total electricity for the above, kWh/year	105.5134 (231)
Electricity for lighting (calculated in Appendix L)	125.3792 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-555.4776 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1906.8888 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	18.5404	25.1600	4.6648	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	25.1600	556.7741	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	105.5134	25.1600	26.5472	(249)
Energy for lighting	125.3792	25.1600	31.5454	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.7700	25.1600	-92.5309	
PV Unit electricity exported	-187.7076	5.8100	-10.9058	
Total			-103.4367	(252)
Total energy cost			516.0946	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	18.5404	0.1612	2.9893	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2212.9335	0.1413	312.5953	(264)
Space and water heating			315.5847	(265)
Pumps, fans and electric keep-hot	105.5134	0.1387	14.6360	(267)
Energy for lighting	125.3792	0.1443	18.0961	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.7700	0.1319	-48.5087	
PV Unit electricity exported	-187.7076	0.1230	-23.0860	
Total			-71.5947	(269)
Total CO2, kg/year			276.7220	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	18.5404	1.5966	29.6024	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2212.9335	1.5223	3368.8373	(278)
Space and water heating			3398.4396	(279)

Pumps, fans and electric keep-hot	105.5134	1.5128	159.6207 (281)
Energy for lighting	125.3792	1.5338	192.3107 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-367.7700	1.4873	-546.9961
PV Unit electricity exported	-187.7076	0.4514	-84.7250
Total			-631.7212 (283)
Total Primary energy kWh/year			3118.6499 (286)

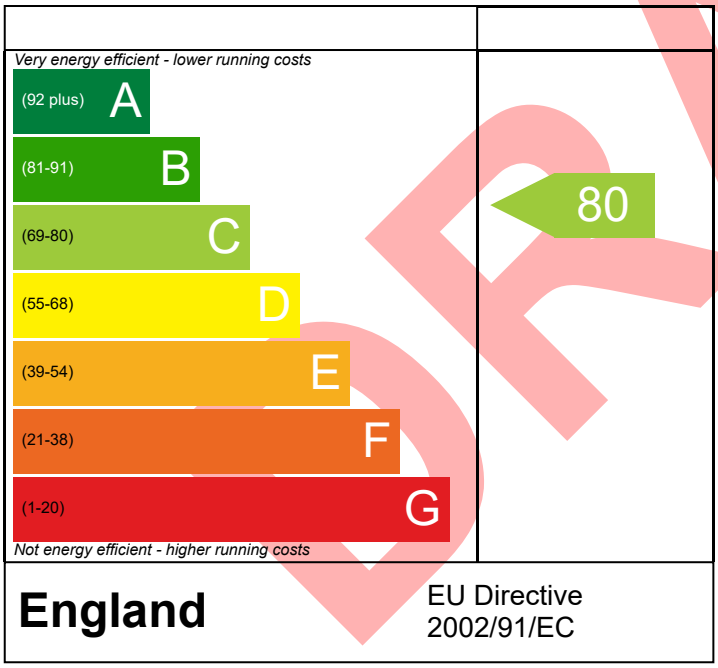
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	51.48 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

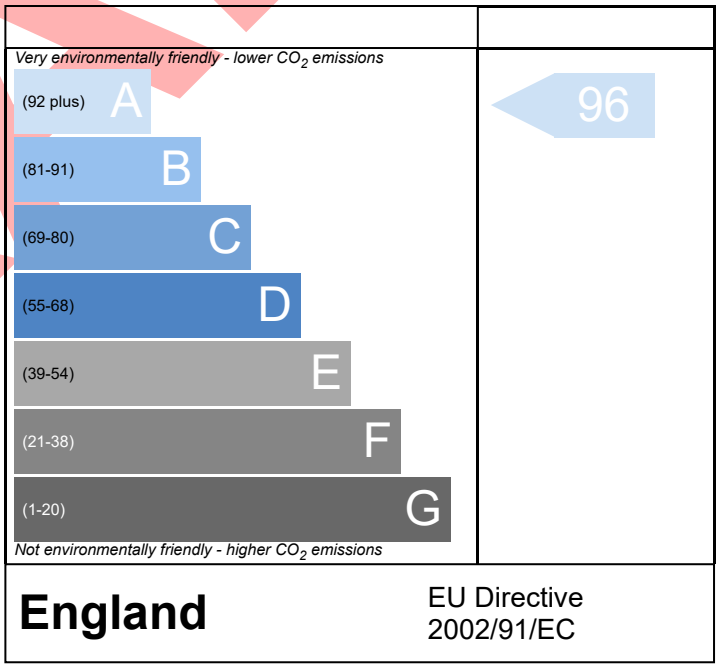
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:32

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	66 m^2
Site Reference	Unit 424 L02_Copy	Plot Reference	Unit 424 L02_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*12.09 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	5.93 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*65.27 kWh_{PE}/m^2*	
Dwelling primary energy	65.5 kWh_{PE}/m^2	FAIL
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*25.4 kWh/m^2*	
Dwelling fabric energy efficiency	26.5 kWh/m^2	FAIL

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	21.53	0.14 **(!)**
Party wall: Party Wall (1)	30.24	0 **(!)**
Party wall: Party Wall (2)	14.18	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	7.88	North East	0.83	1.3
N, Opening Type 1	3.94	North	0.83	1.3
NW, Opening Type 1	7.88	North West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.85 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 424 L02_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 424 L02_Copy	**Prop Type Ref**	Unit 424 L02
Property			

SAP Rating	77 C	**DER**	5.93	**TER**	12.09
Environmental	95 A	**% DER < TER**			50.95
CO_2 Emissions (t/year)	0.39	**DFEE**	26.45	**TFEE**	25.40
Compliance Check	See BREL	**% DFEE < TFEE**			-4.14
% DPER < TPER	-0.36	**DPER**	65.50	**TPER**	65.27

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.6000 (1b)	x	2.4000 (2b)	=	157.4400	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.6000					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	157.4400	(5)

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2. Ventilation rate

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	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.7000	1.2357	24.3441			(27)
External Wall 1	41.2300	19.7000	21.5300	0.1400	3.0142	14.0000	301.4200	(29a)
Total net area of external elements Aum(A, m2)			41.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.3583			(33)
Party Wall 1			30.2400	0.0000	0.0000	20.0000	604.8000	(32)
Wall to corridor			14.1800	0.0000	0.0000	20.0000	283.6000	(32)
Party Floor 1			65.6000			80.0000	5248.0000	(32d)
Party Ceiling 1			65.6000			80.0000	5248.0000	(32b)
Internal Wall 1			114.4800			9.0000	1030.3200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12716.1400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		193.8436 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240

E4 Jamb	23.2000	0.0500	1.1600	
E7 Party floor between dwellings (in blocks of flats)	15.2700	0.0700	1.0689	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.4500	0.0000	0.0000	
E16 Corner (normal)	5.4000	0.0900	0.4860	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.4629 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 30.8212 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.7197	15.5541	15.3885	14.5604	14.3948	13.5668	13.5668	13.4012	13.8980	14.3948	14.7261	15.0573	(38)
Heat transfer coeff	46.5409	46.3753	46.2097	45.3817	45.2160	44.3880	44.3880	44.2224	44.7192	45.2160	45.5473	45.8785	(39)
Average = Sum(39)m / 12 =												45.3402	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7095	0.7069	0.7044	0.6918	0.6893	0.6766	0.6766	0.6741	0.6817	0.6893	0.6943	0.6994	(40)
HLP (average)												0.6912	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1348 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	82.5173	81.2772	79.4702	76.0128	73.4613	70.6159	68.9985	70.7919	72.7577	75.8128	79.3445	82.2011	(42a)
Hot water usage for baths	25.9306	25.5455	25.0032	24.0033	23.2545	22.4243	21.9759	22.5144	23.1007	23.9891	25.0096	25.8429	(42b)
Hot water usage for other uses	36.4921	35.1651	33.8381	32.5112	31.1842	29.8572	29.8572	31.1842	32.5112	33.8381	35.1651	36.4921	(42c)
Average daily hot water use (litres/day)												133.2946	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.9400	141.9879	138.3115	132.5272	127.9000	122.8974	120.8316	124.4905	128.3696	133.6401	139.5193	144.5362	(44)
Energy conte	229.5496	202.1888	212.5797	181.4231	172.1780	151.1167	146.1353	154.1452	158.2926	181.3483	198.7708	226.3088	(45)
Energy content (annual)										Total = Sum(45)m =		2214.0368	
Distribution loss (46)m = 0.15 x (45)m	34.4324	30.3283	31.8870	27.2135	25.8267	22.6675	21.9203	23.1218	23.7439	27.2023	29.8156	33.9463	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
										Total per year (kWh/year) = Sum(64)m =		2461.0688	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	93.1099	82.3881	87.4674	76.5664	74.0338	66.4895	65.3746	68.0379	68.8755	77.0830	82.3345	92.0323	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.5047	19.1002	15.5334	11.7598	8.7906	7.4214	8.0190	10.4234	13.9903	17.7639	20.7331	22.1023	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	278.8333	281.7267	274.4354	258.9131	239.3189	220.9031	208.6002	205.7068	212.9981	228.5205	248.1147	266.5304	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	(71)
Water heating gains (Table 5)	125.1477	122.6013	117.5637	106.3422	99.5078	92.3465	87.8691	91.4488	95.6604	103.6061	114.3535	123.6993	(72)
Total internal gains	518.1243	516.0669	500.1711	469.6536	440.2559	413.3096	397.1270	400.2177	415.2875	442.5292	475.8399	504.9707	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.9400	10.6334	0.6300	0.8270	0.7700	15.1268	(74)
Northeast	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(75)
Northwest	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(81)

Solar gains	79.3302	159.5959	284.5798	465.5919	626.0753	667.9328	624.6267	497.5518	345.9696	194.1222	99.4453	65.0422	(83)
Total gains	597.4544	675.6629	784.7509	935.2456	1066.3312	1081.2424	1021.7538	897.7695	761.2571	636.6514	575.2852	570.0129	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
tau	75.8958	76.1669	76.4398	77.8346	78.1196	79.5769	79.5769	79.8749	78.9875	78.1196	77.5516	76.9917	
alpha	6.0597	6.0778	6.0960	6.1890	6.2080	6.3051	6.3051	6.3250	6.2658	6.2080	6.1701	6.1328	
util living area	0.9443	0.8978	0.7832	0.5780	0.3936	0.2627	0.1911	0.2266	0.4045	0.7055	0.8982	0.9537	(86)
MIT	20.5309	20.6915	20.8778	20.9810	20.9983	20.9999	21.0000	21.0000	20.9986	20.9533	20.7428	20.4986	(87)
Th 2	20.3325	20.3347	20.3369	20.3481	20.3503	20.3615	20.3615	20.3637	20.3570	20.3503	20.3459	20.3414	(88)
util rest of house	0.9345	0.8822	0.7583	0.5489	0.3663	0.2365	0.1634	0.1952	0.3671	0.6691	0.8801	0.9453	(89)
MIT 2	19.8018	19.9963	20.2115	20.3306	20.3489	20.3614	20.3615	20.3637	20.3561	20.3080	20.0708	19.7701	(90)
Living area fraction										fLA = Living area / (4) =		0.4663	(91)
MIT	20.1418	20.3205	20.5222	20.6339	20.6517	20.6592	20.6592	20.6604	20.6557	20.6089	20.3842	20.1098	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1418	20.3205	20.5222	20.6339	20.6517	20.6592	20.6592	20.6604	20.6557	20.6089	20.3842	20.1098	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9314	0.8819	0.7654	0.5617	0.3790	0.2487	0.1763	0.2099	0.3845	0.6838	0.8813	0.9420	(94)
Useful gains	556.4905	595.8544	600.6754	525.3550	404.1465	268.9229	180.1788	188.3983	292.7083	435.3670	506.9831	536.9353	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	737.2932	715.1300	647.9614	532.5036	404.7612	268.9542	180.1814	188.4059	293.1651	452.5628	605.0574	729.9177	(97)
Space heating kWh	134.5172	80.1532	35.1808	5.1470	0.4573	0.0000	0.0000	0.0000	0.0000	12.7937	70.6135	143.5789	(98a)
Space heating requirement - total per year (kWh/year)												482.4417	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	134.5172	80.1532	35.1808	5.1470	0.4573	0.0000	0.0000	0.0000	0.0000	12.7937	70.6135	143.5789	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												482.4417	
Space heating per m2											(98c) / (4) =	7.3543	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	134.5172	80.1532	35.1808	5.1470	0.4573	0.0000	0.0000	0.0000	0.0000	12.7937	70.6135	143.5789	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	134.5172	80.1532	35.1808	5.1470	0.4573	0.0000	0.0000	0.0000	0.0000	12.7937	70.6135	143.5789	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	12.1045	10.9331	12.1045	11.7141	12.1045	11.7141	12.1045	12.1045	11.7141	12.1045	11.7141	12.1045	(231)
Lighting	18.8229	15.1004	13.5963	9.9612	7.6943	6.2863	7.0190	9.1236	11.8506	15.5487	17.5622	19.3460	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.8213	-25.1442	-40.5995	-50.8074	-59.6191	-57.3843	-56.4723	-50.9617	-41.6122	-30.4702	-18.2075	-13.3329	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.9134	-6.9726	-15.9981	-27.1982	-38.1750	-39.2360	-38.6794	-31.3088	-21.3818	-11.1391	-4.1917	-2.2203	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	482.4417	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2461.0688	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	142.5210	(230a)
Total electricity for the above, kWh/year	142.5210	(231)
Electricity for lighting (calculated in Appendix L)	151.9116	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-699.8470	(233)
Wind generation	0.0000	(234)

Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2538.0960	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	482.4417	16.4900	79.5546	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	16.4900	405.8302	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	142.5210	16.4900	23.5017	(249)
Energy for lighting	151.9116	16.4900	25.0502	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.4327	16.4900	-75.9253	
PV Unit electricity exported	-239.4143	5.5900	-13.3833	
Total			-89.3086	(252)
Total energy cost			444.6282	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.4473	(257)
SAP value	76.5400	
SAP rating (Section 12)	77	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	482.4417	0.1591	76.7358	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2461.0688	0.1413	347.7259	(264)
Space and water heating			424.4617	(265)
Pumps, fans and electric keep-hot	142.5210	0.1387	19.7694	(267)
Energy for lighting	151.9116	0.1443	21.9255	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.4327	0.1324	-60.9543	
PV Unit electricity exported	-239.4143	0.1230	-29.4456	
Total			-90.3999	(269)
Total CO2, kg/year			375.7568	(272)
CO2 emissions per m2			5.7300	(273)
EI value			95.4474	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.6000 (1b)	x	2.4000 (2b)	=	157.4400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	157.4400	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.7000	1.2357	24.3441			(27)
External Wall 1	41.2300	19.7000	21.5300	0.1400	3.0142	14.0000	301.4200	(29a)
Total net area of external elements Aum(A, m2)			41.2300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.3583			(33)
Party Wall 1			30.2400	0.0000	0.0000	20.0000	604.8000	(32)
Wall to corridor			14.1800	0.0000	0.0000	20.0000	283.6000	(32)
Party Floor 1			65.6000			80.0000	5248.0000	(32d)
Party Ceiling 1			65.6000			80.0000	5248.0000	(32b)
Internal Wall 1			114.4800			9.0000	1030.3200	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12716.1400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 193.8436 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	15.2700	0.0700	1.0689
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.4500	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.4629 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 30.8212 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.8853	15.8853	15.5541	14.5604	14.3948	13.7324	13.4012	13.4012	14.0636	14.8917	15.2229	15.0573	(38)
Heat transfer coeff	46.7065	46.7065	46.3753	45.3817	45.2160	44.5536	44.2224	44.2224	44.8848	45.7129	46.0441	45.8785	(39)

Average = Sum(39)m / 12 = 45.4921

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7120	0.7120	0.7069	0.6918	0.6893	0.6792	0.6741	0.6741	0.6842	0.6968	0.7019	0.6994	(40)
HLP (average)												0.6935	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1348 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	82.5173	81.2772	79.4702	76.0128	73.4613	70.6159	68.9985	70.7919	72.7577	75.8128	79.3445	82.2011	(42a)
Hot water usage for baths	25.9306	25.5455	25.0032	24.0033	23.2545	22.4243	21.9759	22.5144	23.1007	23.9891	25.0096	25.8429	(42b)
Hot water usage for other uses	36.4921	35.1651	33.8381	32.5112	31.1842	29.8572	29.8572	31.1842	32.5112	33.8381	35.1651	36.4921	(42c)

Average daily hot water use (litres/day) 133.2946 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.9400	141.9879	138.3115	132.5272	127.9000	122.8974	120.8316	124.4905	128.3696	133.6401	139.5193	144.5362	(44)
Energy conte	229.5496	202.1888	212.5797	181.4231	172.1780	151.1167	146.1353	154.1452	158.2926	181.3483	198.7708	226.3088	(45)

Energy content (annual) Total = Sum(45)m = 2214.0368
Distribution loss (46)m = 0.15 x (45)m

	34.4324	30.3283	31.8870	27.2135	25.8267	22.6675	21.9203	23.1218	23.7439	27.2023	29.8156	33.9463	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)

Total per year (kWh/year) = Sum(64)m = 2461.0688 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

	93.1099	82.3881	87.4674	76.5664	74.0338	66.4895	65.3746	68.0379	68.8755	77.0830	82.3345	92.0323	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	21.5047	19.1002	15.5334	11.7598	8.7906	7.4214	8.0190	10.4234	13.9903	17.7639	20.7331	22.1023	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	278.8333	281.7267	274.4354	258.9131	239.3189	220.9031	208.6002	205.7068	212.9981	228.5205	248.1147	266.5304	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	(71)

Water heating gains (Table 5)

	125.1477	122.6013	117.5637	106.3422	99.5078	92.3465	87.8691	91.4488	95.6604	103.6061	114.3535	123.6993	(72)

Total internal gains

	518.1243	516.0669	500.1711	469.6536	440.2559	413.3096	397.1270	400.2177	415.2875	442.5292	475.8399	504.9707	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.9400	9.5462	0.6300	0.8270	0.7700	13.5802	(74)
Northeast	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(75)
Northwest	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(81)

Solar gains	70.6592	151.1252	280.9264	484.6236	648.1368	673.8739	637.2294	491.4241	338.5882	182.4575	90.9142	59.3240	(83)
Total gains	588.7835	667.1921	781.0975	954.2772	1088.3927	1087.1835	1034.3564	891.6418	753.8757	624.9867	566.7541	564.2947	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	75.6267	75.6267	76.1669	77.8346	78.1196	79.2811	79.8749	79.8749	78.6961	77.2706	76.7148	76.9917	
alpha	6.0418	6.0418	6.0778	6.1890	6.2080	6.2854	6.3250	6.3250	6.2464	6.1514	6.1143	6.1328	
util living area	0.9528	0.9156	0.8175	0.6100	0.4266	0.3195	0.2608	0.3074	0.4854	0.7668	0.9173	0.9609	(86)
MIT	20.4771	20.6279	20.8334	20.9726	20.9970	20.9996	20.9999	20.9998	20.9952	20.9176	20.6842	20.4449	(87)
Th 2	20.3303	20.3303	20.3347	20.3481	20.3503	20.3593	20.3637	20.3637	20.3548	20.3436	20.3392	20.3414	(88)
util rest of house	0.9444	0.9024	0.7954	0.5823	0.4001	0.2933	0.2336	0.2759	0.4481	0.7341	0.9020	0.9538	(89)
MIT 2	19.7336	19.9162	20.1594	20.3220	20.3478	20.3590	20.3637	20.3636	20.3512	20.2651	19.9956	19.7034	(90)
Living area fraction									fLA = Living area / (4) =			0.4663	(91)
MIT	20.0803	20.2481	20.4737	20.6254	20.6505	20.6577	20.6604	20.6602	20.6515	20.5693	20.3167	20.0492	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0803	20.2481	20.4737	20.6254	20.6505	20.6577	20.6604	20.6602	20.6515	20.5693	20.3167	20.0492	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9409	0.9006	0.8002	0.5942	0.4124	0.3055	0.2462	0.2906	0.4653	0.7457	0.9015	0.9502	(94)
Useful gains	553.9998	600.9017	625.0485	567.0295	448.8241	332.1337	254.7102	259.0800	350.7832	466.0568	510.9054	536.2051	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	755.7237	744.8799	689.7723	577.4985	449.9220	332.2678	254.7373	259.1542	352.4136	496.8690	631.5725	750.0759	(97)
Space heating kWh	150.0826	96.7533	48.1545	7.5377	0.8168	0.0000	0.0000	0.0000	0.0000	22.9242	86.8803	159.1198	(98a)
Space heating requirement - total per year (kWh/year)												572.2692	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	150.0826	96.7533	48.1545	7.5377	0.8168	0.0000	0.0000	0.0000	0.0000	22.9242	86.8803	159.1198	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												572.2692	
Space heating per m2											(98c) / (4) =	8.7236	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	150.0826	96.7533	48.1545	7.5377	0.8168	0.0000	0.0000	0.0000	0.0000	22.9242	86.8803	159.1198	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	150.0826	96.7533	48.1545	7.5377	0.8168	0.0000	0.0000	0.0000	0.0000	22.9242	86.8803	159.1198	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
Efficiency of water heater												100.0000	(216)

(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	12.1045	10.9331	12.1045	11.7141	12.1045	11.7141	12.1045	12.1045	11.7141	12.1045	11.7141	12.1045	(231)
Lighting	18.8229	15.1004	13.5963	9.9612	7.6943	6.2863	7.0190	9.1236	11.8506	15.5487	17.5622	19.3460	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.3390	-24.2607	-40.7585	-53.0224	-61.7331	-58.2186	-57.7804	-50.9772	-41.3377	-29.2909	-16.9632	-12.3287	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4522	-6.4407	-15.8198	-29.2502	-40.7180	-40.3248	-40.3981	-31.3264	-21.1298	-10.2458	-3.6627	-1.9316	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	572.2692	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2461.0688	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	142.5210	(230a)
Total electricity for the above, kWh/year	142.5210	(231)
Electricity for lighting (calculated in Appendix L)	151.9116	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-704.7104	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2623.0602	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	572.2692	25.1600	143.9829	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	25.1600	619.2049	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	142.5210	25.1600	35.8583	(249)
Energy for lighting	151.9116	25.1600	38.2210	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-461.0103	25.1600	-115.9902	
PV Unit electricity exported	-243.7000	5.8100	-14.1590	
Total			-130.1492	(252)
Total energy cost			707.1179	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	572.2692	0.1584	90.6705	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2461.0688	0.1413	347.7259	(264)
Space and water heating			438.3964	(265)
Pumps, fans and electric keep-hot	142.5210	0.1387	19.7694	(267)
Energy for lighting	151.9116	0.1443	21.9255	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-461.0103	0.1321	-60.8931	
PV Unit electricity exported	-243.7000	0.1225	-29.8428	
Total			-90.7359	(269)
Total CO2, kg/year			389.3554	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	572.2692	1.5865	907.8795	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	1.5225	3746.8812	(278)
Space and water heating			4654.7607	(279)
Pumps, fans and electric keep-hot	142.5210	1.5128	215.6057	(281)
Energy for lighting	151.9116	1.5338	233.0071	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-461.0103	1.4880	-685.9989	
PV Unit electricity exported	-243.7000	0.4494	-109.5201	
Total			-795.5190	(283)
Total Primary energy kWh/year			4307.8545	(286)

SAP 10 EPC IMPROVEMENTS

Unit 424 L02_Copy

Current energy efficiency rating: C 77
Current environmental impact rating: A 95

N Solar water heating	Not applicable
U Solar photovoltaic panels	Not applicable
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 77
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£837	£837	£0
Space heating	£180	£180	£0
Water heating	£619	£619	£0
Lighting	£38	£38	£0
Generated (PV)	-£130	-£130	£0
Total cost of fuels	£707	£707	£0
Total cost of uses	£707	£707	£0
Delivered energy	40 kWh/m²	40 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	66 kWh/m²	66 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.6000 (1b)	x	2.4000 (2b)	=	157.4400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	157.4400	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.7000	1.2357	24.3441			(27)
External Wall 1	41.2300	19.7000	21.5300	0.1400	3.0142	14.0000	301.4200	(29a)
Total net area of external elements Aum(A, m2)			41.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.3583			(33)
Party Wall 1			30.2400	0.0000	0.0000	20.0000	604.8000	(32)
Wall to corridor			14.1800	0.0000	0.0000	20.0000	283.6000	(32)
Party Floor 1			65.6000			80.0000	5248.0000	(32d)
Party Ceiling 1			65.6000			80.0000	5248.0000	(32b)
Internal Wall 1			114.4800			9.0000	1030.3200	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12716.1400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 193.8436 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	15.2700	0.0700	1.0689
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.4500	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.4629 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 30.8212 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.7197	15.5541	15.3885	14.5604	14.3948	13.5668	13.5668	13.4012	13.8980	14.3948	14.7261	15.0573	(38)
Heat transfer coeff	46.5409	46.3753	46.2097	45.3817	45.2160	44.3880	44.3880	44.2224	44.7192	45.2160	45.5473	45.8785	(39)

Average = Sum(39)m / 12 = 45.3402

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7095	0.7069	0.7044	0.6918	0.6893	0.6766	0.6766	0.6741	0.6817	0.6893	0.6943	0.6994	(40)
HLP (average)												0.6912	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1348 (42)
Hot water usage for mixer showers

82.5173	81.2772	79.4702	76.0128	73.4613	70.6159	68.9985	70.7919	72.7577	75.8128	79.3445	82.2011	(42a)

Hot water usage for baths

25.9306	25.5455	25.0032	24.0033	23.2545	22.4243	21.9759	22.5144	23.1007	23.9891	25.0096	25.8429	(42b)

Hot water usage for other uses

36.4921	35.1651	33.8381	32.5112	31.1842	29.8572	29.8572	31.1842	32.5112	33.8381	35.1651	36.4921	(42c)

Average daily hot water use (litres/day) 133.2946 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.9400	141.9879	138.3115	132.5272	127.9000	122.8974	120.8316	124.4905	128.3696	133.6401	139.5193	144.5362	(44)
Energy conte	229.5496	202.1888	212.5797	181.4231	172.1780	151.1167	146.1353	154.1452	158.2926	181.3483	198.7708	226.3088	(45)

Energy content (annual) Total = Sum(45)m = 2214.0368
Distribution loss (46)m = 0.15 x (45)m

34.4324	30.3283	31.8870	27.2135	25.8267	22.6675	21.9203	23.1218	23.7439	27.2023	29.8156	33.9463	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)

Total per year (kWh/year) = Sum(64)m = 2461.0688 (64)
Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month

93.1099	82.3881	87.4674	76.5664	74.0338	66.4895	65.3746	68.0379	68.8755	77.0830	82.3345	92.0323	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.5047	19.1002	15.5334	11.7598	8.7906	7.4214	8.0190	10.4234	13.9903	17.7639	20.7331	22.1023	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	278.8333	281.7267	274.4354	258.9131	239.3189	220.9031	208.6002	205.7068	212.9981	228.5205	248.1147	266.5304	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	(71)
Water heating gains (Table 5)	125.1477	122.6013	117.5637	106.3422	99.5078	92.3465	87.8691	91.4488	95.6604	103.6061	114.3535	123.6993	(72)

Total internal gains

	518.1243	516.0669	500.1711	469.6536	440.2559	413.3096	397.1270	400.2177	415.2875	442.5292	475.8399	504.9707 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.9400	10.6334	0.6300	0.8270	0.7700	15.1268	(74)
Northeast	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(75)
Northwest	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(81)

Solar gains	79.3302	159.5959	284.5798	465.5919	626.0753	667.9328	624.6267	497.5518	345.9696	194.1222	99.4453	65.0422	(83)
Total gains	597.4544	675.6629	784.7509	935.2456	1066.3312	1081.2424	1021.7538	897.7695	761.2571	636.6514	575.2852	570.0129	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	75.8958	76.1669	76.4398	77.8346	78.1196	79.5769	79.5769	79.8749	78.9875	78.1196	77.5516	76.9917	
alpha	6.0597	6.0778	6.0960	6.1890	6.2080	6.3051	6.3051	6.3250	6.2658	6.2080	6.1701	6.1328	
util living area	0.9443	0.8978	0.7832	0.5780	0.3936	0.2627	0.1911	0.2266	0.4045	0.7055	0.8982	0.9537	(86)
MIT	20.5309	20.6915	20.8778	20.9810	20.9983	20.9999	21.0000	21.0000	20.9986	20.9533	20.7428	20.4986	(87)
Th 2	20.3325	20.3347	20.3369	20.3481	20.3503	20.3615	20.3615	20.3637	20.3570	20.3503	20.3459	20.3414	(88)
util rest of house	0.9345	0.8822	0.7583	0.5489	0.3663	0.2365	0.1634	0.1952	0.3671	0.6691	0.8801	0.9453	(89)
MIT 2	19.8018	19.9963	20.2115	20.3306	20.3489	20.3614	20.3615	20.3637	20.3561	20.3080	20.0708	19.7701	(90)
Living area fraction									fLA = Living area / (4) =			0.4663	(91)
MIT	20.1418	20.3205	20.5222	20.6339	20.6517	20.6592	20.6592	20.6604	20.6557	20.6089	20.3842	20.1098	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1418	20.3205	20.5222	20.6339	20.6517	20.6592	20.6592	20.6604	20.6557	20.6089	20.3842	20.1098	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9314	0.8819	0.7654	0.5617	0.3790	0.2487	0.1763	0.2099	0.3845	0.6838	0.8813	0.9420	(94)
Useful gains	556.4905	595.8544	600.6754	525.3550	404.1465	268.9229	180.1788	188.3983	292.7083	435.3670	506.9831	536.9353	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	737.2932	715.1300	647.9614	532.5036	404.7612	268.9542	180.1814	188.4059	293.1651	452.5628	605.0574	729.9177	(97)
Space heating kWh	134.5172	80.1532	35.1808	5.1470	0.4573	0.0000	0.0000	0.0000	0.0000	12.7937	70.6135	143.5789	(98a)
Space heating requirement - total per year (kWh/year)												482.4417	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	134.5172	80.1532	35.1808	5.1470	0.4573	0.0000	0.0000	0.0000	0.0000	12.7937	70.6135	143.5789	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												482.4417	
Space heating per m2											(98c) / (4) =	7.3543	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	134.5172	80.1532	35.1808	5.1470	0.4573	0.0000	0.0000	0.0000	0.0000	12.7937	70.6135	143.5789	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	134.5172	80.1532	35.1808	5.1470	0.4573	0.0000	0.0000	0.0000	0.0000	12.7937	70.6135	143.5789	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	12.1045	10.9331	12.1045	11.7141	12.1045	11.7141	12.1045	12.1045	11.7141	12.1045	11.7141	12.1045	(231)
Lighting	18.8229	15.1004	13.5963	9.9612	7.6943	6.2863	7.0190	9.1236	11.8506	15.5487	17.5622	19.3460	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.8213	-25.1442	-40.5995	-50.8074	-59.6191	-57.3843	-56.4723	-50.9617	-41.6122	-30.4702	-18.2075	-13.3329	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													

(233b)m	-2.9134	-6.9726	-15.9981	-27.1982	-38.1750	-39.2360	-38.6794	-31.3088	-21.3818	-11.1391	-4.1917	-2.2203	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	482.4417	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2461.0688	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	142.5210	(230a)
Total electricity for the above, kWh/year	142.5210	(231)
Electricity for lighting (calculated in Appendix L)	151.9116	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-699.8470	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2538.0960	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	482.4417	16.4900	79.5546	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	16.4900	405.8302	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	142.5210	16.4900	23.5017	(249)
Energy for lighting	151.9116	16.4900	25.0502	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.4327	16.4900	-75.9253	
PV Unit electricity exported	-239.4143	5.5900	-13.3833	
Total			-89.3086	(252)
Total energy cost			444.6282	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.4473	(257)
SAP value		76.5400	
SAP rating (Section 12)		77	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	482.4417	0.1591	76.7358	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2461.0688	0.1413	347.7259	(264)
Space and water heating			424.4617	(265)
Pumps, fans and electric keep-hot	142.5210	0.1387	19.7694	(267)
Energy for lighting	151.9116	0.1443	21.9255	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-460.4327	0.1324	-60.9543	
PV Unit electricity exported	-239.4143	0.1230	-29.4456	
Total			-90.3999	(269)
Total CO2, kg/year			375.7568	(272)
CO2 emissions per m2			5.7300	(273)
EI value			95.4474	
EI rating			95	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		65.6000 (1b)	x	2.4000 (2b)	=	157.4400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.6000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	157.4400	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.7000	1.2357	24.3441			(27)
External Wall 1	41.2300	19.7000	21.5300	0.1400	3.0142	14.0000	301.4200	(29a)
Total net area of external elements Aum(A, m2)			41.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.3583			(33)
Party Wall 1			30.2400	0.0000	0.0000	20.0000	604.8000	(32)
Wall to corridor			14.1800	0.0000	0.0000	20.0000	283.6000	(32)
Party Floor 1			65.6000			80.0000	5248.0000	(32d)
Party Ceiling 1			65.6000			80.0000	5248.0000	(32b)
Internal Wall 1			114.4800			9.0000	1030.3200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12716.1400	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	193.8436	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	15.2700	0.0700	1.0689
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.4500	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	3.4629	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	30.8212	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.8853	15.8853	15.5541	14.5604	14.3948	13.7324	13.4012	13.4012	14.0636	14.8917	15.2229	15.0573	(38)
Heat transfer coeff	46.7065	46.7065	46.3753	45.3817	45.2160	44.5536	44.2224	44.2224	44.8848	45.7129	46.0441	45.8785	(39)
Average = Sum(39)m / 12 =												45.4921	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7120	0.7120	0.7069	0.6918	0.6893	0.6792	0.6741	0.6741	0.6842	0.6968	0.7019	0.6994	(40)
HLP (average)												0.6935	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1348	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
82.5173	81.2772	79.4702	76.0128	73.4613	70.6159	68.9985	70.7919	72.7577	75.8128	79.3445	82.2011	(42a)

Hot water usage for baths

25.9306	25.5455	25.0032	24.0033	23.2545	22.4243	21.9759	22.5144	23.1007	23.9891	25.0096	25.8429	(42b)

Hot water usage for other uses

36.4921	35.1651	33.8381	32.5112	31.1842	29.8572	29.8572	31.1842	32.5112	33.8381	35.1651	36.4921	(42c)

Average daily hot water use (litres/day)	133.2946 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.9400	141.9879	138.3115	132.5272	127.9000	122.8974	120.8316	124.4905	128.3696	133.6401	139.5193	144.5362	(44)
Energy conte	229.5496	202.1888	212.5797	181.4231	172.1780	151.1167	146.1353	154.1452	158.2926	181.3483	198.7708	226.3088	(45)
Energy content (annual)										Total = Sum(45)m =		2214.0368	

Distribution loss (46)m = 0.15 x (45)m

34.4324	30.3283	31.8870	27.2135	25.8267	22.6675	21.9203	23.1218	23.7439	27.2023	29.8156	33.9463	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)

Total per year (kWh/year) = Sum(64)m = 2461.0688 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

93.1099	82.3881	87.4674	76.5664	74.0338	66.4895	65.3746	68.0379	68.8755	77.0830	82.3345	92.0323	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	128.0858	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

21.5047	19.1002	15.5334	11.7598	8.7906	7.4214	8.0190	10.4234	13.9903	17.7639	20.7331	22.1023	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

278.8333	281.7267	274.4354	258.9131	239.3189	220.9031	208.6002	205.7068	212.9981	228.5205	248.1147	266.5304	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	49.9433	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	-85.3906	(71)

Water heating gains (Table 5)

125.1477	122.6013	117.5637	106.3422	99.5078	92.3465	87.8691	91.4488	95.6604	103.6061	114.3535	123.6993	(72)

Total internal gains

518.1243	516.0669	500.1711	469.6536	440.2559	413.3096	397.1270	400.2177	415.2875	442.5292	475.8399	504.9707	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.9400	9.5462	0.6300	0.8270	0.7700	13.5802	(74)
Northeast	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(75)
Northwest	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(81)

Solar gains 70.6592	151.1252	280.9264	484.6236	648.1368	673.8739	637.2294	491.4241	338.5882	182.4575	90.9142	59.3240	(83)
Total gains 588.7835	667.1921	781.0975	954.2772	1088.3927	1087.1835	1034.3564	891.6418	753.8757	624.9867	566.7541	564.2947	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	75.6267	75.6267	76.1669	77.8346	78.1196	79.2811	79.8749	79.8749	78.6961	77.2706	76.7148	76.9917	
alpha	6.0418	6.0418	6.0778	6.1890	6.2080	6.2854	6.3250	6.3250	6.2464	6.1514	6.1143	6.1328	
util living area													
	0.9528	0.9156	0.8175	0.6100	0.4266	0.3195	0.2608	0.3074	0.4854	0.7668	0.9173	0.9609	(86)
MIT	20.4771	20.6279	20.8334	20.9726	20.9970	20.9996	20.9999	20.9998	20.9952	20.9176	20.6842	20.4449	(87)
Th 2	20.3303	20.3303	20.3347	20.3481	20.3503	20.3593	20.3637	20.3637	20.3548	20.3436	20.3392	20.3414	(88)
util rest of house													
	0.9444	0.9024	0.7954	0.5823	0.4001	0.2933	0.2336	0.2759	0.4481	0.7341	0.9020	0.9538	(89)
MIT 2	19.7336	19.9162	20.1594	20.3220	20.3478	20.3590	20.3637	20.3636	20.3512	20.2651	19.9956	19.7034	(90)
Living area fraction									fLA = Living area / (4) =			0.4663	(91)
MIT	20.0803	20.2481	20.4737	20.6254	20.6505	20.6577	20.6604	20.6602	20.6515	20.5693	20.3167	20.0492	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0803	20.2481	20.4737	20.6254	20.6505	20.6577	20.6604	20.6602	20.6515	20.5693	20.3167	20.0492	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9409	0.9006	0.8002	0.5942	0.4124	0.3055	0.2462	0.2906	0.4653	0.7457	0.9015	0.9502	(94)
Useful gains	553.9998	600.9017	625.0485	567.0295	448.8241	332.1337	254.7102	259.0800	350.7832	466.0568	510.9054	536.2051	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	755.7237	744.8799	689.7723	577.4985	449.9220	332.2678	254.7373	259.1542	352.4136	496.8690	631.5725	750.0759	(97)
Space heating kWh													
	150.0826	96.7533	48.1545	7.5377	0.8168	0.0000	0.0000	0.0000	0.0000	22.9242	86.8803	159.1198	(98a)
Space heating requirement - total per year (kWh/year)												572.2692	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	150.0826	96.7533	48.1545	7.5377	0.8168	0.0000	0.0000	0.0000	0.0000	22.9242	86.8803	159.1198	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												572.2692	
Space heating per m2											(98c) / (4) =	8.7236	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	150.0826	96.7533	48.1545	7.5377	0.8168	0.0000	0.0000	0.0000	0.0000	22.9242	86.8803	159.1198	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	150.0826	96.7533	48.1545	7.5377	0.8168	0.0000	0.0000	0.0000	0.0000	22.9242	86.8803	159.1198	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	250.5304	221.1392	233.5605	201.7271	193.1588	171.4207	167.1161	175.1260	178.5966	202.3291	219.0748	247.2896	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	12.1045	10.9331	12.1045	11.7141	12.1045	11.7141	12.1045	12.1045	11.7141	12.1045	11.7141	12.1045	(231)
Lighting	18.8229	15.1004	13.5963	9.9612	7.6943	6.2863	7.0190	9.1236	11.8506	15.5487	17.5622	19.3460	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.3390	-24.2607	-40.7585	-53.0224	-61.7331	-58.2186	-57.7804	-50.9772	-41.3377	-29.2909	-16.9632	-12.3287	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4522	-6.4407	-15.8198	-29.2502	-40.7180	-40.3248	-40.3981	-31.3264	-21.1298	-10.2458	-3.6627	-1.9316	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												572.2692	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2461.0688	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)													
mechanical ventilation fans (SFP = 0.7420)												142.5210	(230a)
Total electricity for the above, kWh/year												142.5210	(231)
Electricity for lighting (calculated in Appendix L)												151.9116	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-704.7104	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2623.0602	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	572.2692	25.1600	143.9829	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	25.1600	619.2049	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	142.5210	25.1600	35.8583	(249)
Energy for lighting	151.9116	25.1600	38.2210	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-461.0103	25.1600	-115.9902	
PV Unit electricity exported	-243.7000	5.8100	-14.1590	
Total			-130.1492	(252)
Total energy cost			707.1179	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	572.2692	0.1584	90.6705	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2461.0688	0.1413	347.7259	(264)
Space and water heating			438.3964	(265)
Pumps, fans and electric keep-hot	142.5210	0.1387	19.7694	(267)
Energy for lighting	151.9116	0.1443	21.9255	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-461.0103	0.1321	-60.8931	
PV Unit electricity exported	-243.7000	0.1225	-29.8428	
Total			-90.7359	(269)
Total CO2, kg/year			389.3554	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	572.2692	1.5865	907.8795	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2461.0688	1.5225	3746.8812	(278)
Space and water heating			4654.7607	(279)
Pumps, fans and electric keep-hot	142.5210	1.5128	215.6057	(281)
Energy for lighting	151.9116	1.5338	233.0071	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-461.0103	1.4880	-685.9989	
PV Unit electricity exported	-243.7000	0.4494	-109.5201	
Total			-795.5190	(283)
Total Primary energy kWh/year			4307.8545	(286)

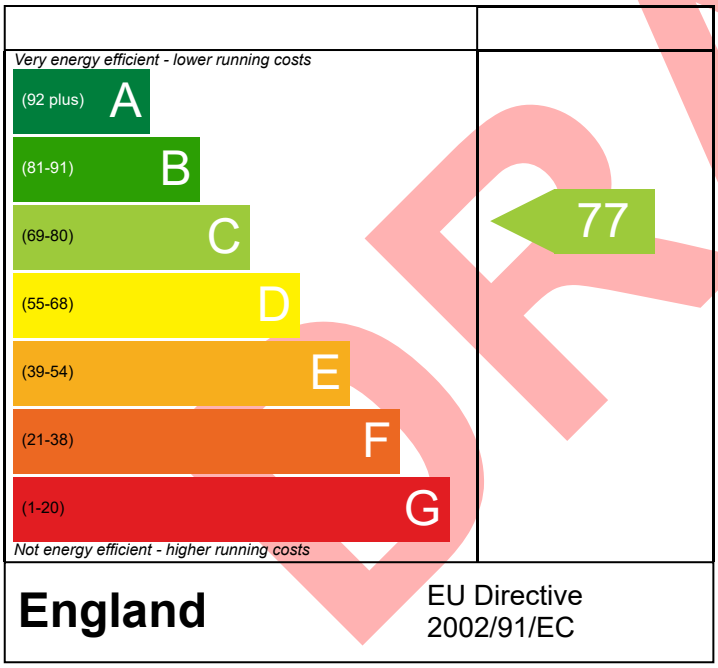
Predicted Energy Assessment

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	65.6 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

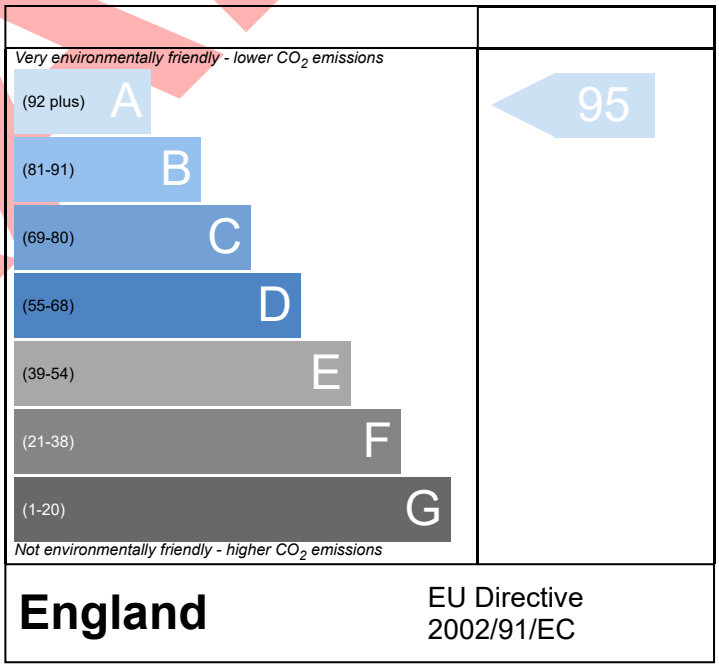
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:33

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	71 m^2
Site Reference	Unit 425 L02_Copy	Plot Reference	Unit 425 L02_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*10.3 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	4.64 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*55.61 kWh$_{PE}$/m^2*	
Dwelling primary energy	52.51 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*18.0 kWh/m^2*	
Dwelling fabric energy efficiency	17.1 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	NE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	11	0.14 **(!)**
Party wall: Party Wall (1)	52.62	0 **(!)**
Party wall: Party Wall (2)	15.55	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
NE, Opening Type 1	11.81	North East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.53 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.92 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 425 L02_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 425 L02_Copy	**Prop Type Ref**	Unit 425 L02
Property			

SAP Rating	80 C	**DER**	4.64	**TER**	10.30
Environmental	96 A	**% DER < TER**			54.95
CO_2 Emissions (t/year)	0.33	**DFEE**	17.06	**TFEE**	17.98
Compliance Check	See BREL	**% DFEE < TFEE**			5.14
% DPER < TPER	5.58	**DPER**	52.51	**TPER**	55.61

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.9800	(1b)	x 2.4000	(2b) =	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		170.3520	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14111.0700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		198.8035 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545

E4 Jamb	13.9200	0.0500	0.6960	
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.8660 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.2026	16.0392	15.8758	15.0589	14.8955	14.0786	14.0786	13.9153	14.4054	14.8955	15.2223	15.5490	(38)
Heat transfer coeff	34.2027	34.0393	33.8759	33.0590	32.8956	32.0787	32.0787	31.9154	32.4055	32.8956	33.2224	33.5491	(39)

Average = Sum(39)m / 12 = 33.0182

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4819	0.4796	0.4773	0.4658	0.4634	0.4519	0.4519	0.4496	0.4565	0.4634	0.4681	0.4727	(40)
HLP (average)												0.4652	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2697 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day) 138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)

Energy content (annual) Total = Sum(45)m = 2297.5146

Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)

Total per year (kWh/year) = Sum(64)m = 2544.5466 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(75)

Solar gains	48.1118	97.9329	176.4440	289.7718	389.5101	415.2590	388.4663	309.6898	214.9998	119.6818	60.5371	39.2905	(83)
Total gains	594.4583	642.1364	703.7861	784.8198	853.3337	850.5024	806.5649	731.0038	652.3178	585.8947	562.0348	571.6354	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.6034	115.1535	115.7089	118.5680	119.1569	122.1913	122.1913	122.8168	120.9592	119.1569	117.9849	116.8358	
alpha	8.6402	8.6769	8.7139	8.9045	8.9438	9.1461	9.1461	9.1878	9.0639	8.9438	8.8657	8.7891	
util living area													
	0.8775	0.8131	0.6885	0.5091	0.3585	0.2414	0.1750	0.2008	0.3428	0.5819	0.7916	0.8914	(86)
MIT	20.8955	20.9454	20.9859	20.9990	21.0000	21.0000	21.0000	21.0000	21.0000	20.9975	20.9643	20.8857	(87)
Th 2	20.5375	20.5396	20.5417	20.5523	20.5544	20.5651	20.5651	20.5672	20.5608	20.5544	20.5502	20.5460	(88)
util rest of house													
	0.8633	0.7958	0.6685	0.4904	0.3413	0.2250	0.1577	0.1819	0.3210	0.5575	0.7712	0.8782	(89)
MIT 2	20.4234	20.4818	20.5277	20.5514	20.5544	20.5651	20.5651	20.5672	20.5608	20.5523	20.5139	20.4203	(90)
Living area fraction										fLA = Living area / (4) =		0.4060	(91)
MIT	20.6151	20.6700	20.7137	20.7331	20.7353	20.7417	20.7417	20.7429	20.7391	20.7331	20.6968	20.6093	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6151	20.6700	20.7137	20.7331	20.7353	20.7417	20.7417	20.7429	20.7391	20.7331	20.6968	20.6093	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8657	0.8008	0.6760	0.4979	0.3483	0.2316	0.1647	0.1896	0.3298	0.5673	0.7780	0.8801	(94)
Useful gains	514.6438	514.2072	475.7927	390.7925	297.2070	197.0168	132.8596	138.6063	215.1380	332.4041	437.2668	503.1190	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	558.0190	536.7995	481.5030	391.1911	297.2225	197.0170	132.8596	138.6063	215.1442	333.3337	451.7174	550.5165	(97)
Space heating kWh													
	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(98a)
Space heating requirement - total per year (kWh/year)												98.3601	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												98.3601	
Space heating per m2											(98c) / (4) =	1.3857	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)
Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.8048	-26.6478	-43.2456	-54.4944	-64.0203	-61.6099	-60.6290	-54.7463	-44.7493	-32.6681	-19.3717	-14.1696	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.4726	-8.1139	-18.0130	-29.9352	-41.8274	-42.9674	-42.3587	-34.2994	-23.4325	-12.3679	-4.8722	-2.6645	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	98.3601	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2544.5466	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	154.2094	(230a)
Total electricity for the above, kWh/year	154.2094	(231)
Electricity for lighting (calculated in Appendix L)	163.7369	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-757.4814	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2203.3717	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	98.3601	16.4900	16.2196	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	16.4900	419.5957	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	16.4900	25.4291	(249)
Energy for lighting	163.7369	16.4900	27.0002	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.1568	16.4900	-81.3216	
PV Unit electricity exported	-264.3246	5.5900	-14.7757	
Total			-96.0973	(252)
Total energy cost			392.1474	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2172	(257)
SAP value		80.2689	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	98.3601	0.1606	15.7950	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			375.3396	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.1568	0.1323	-65.2544	
PV Unit electricity exported	-264.3246	0.1234	-32.6244	
Total			-97.8788	(269)
Total CO2, kg/year			322.4838	(272)
CO2 emissions per m2			4.5400	(273)
EI value			96.2741	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14111.0700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 198.8035 (35)
List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4	Jamb	13.9200	0.0500	0.6960
E7	Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18	Party wall between dwellings	5.4000	0.0600	0.3240
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.8660 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3659	16.3659	16.0392	15.0589	14.8955	14.2420	13.9153	13.9153	14.5688	15.3857	15.7124	15.5490	(38)
Heat transfer coeff	34.3660	34.3660	34.0393	33.0590	32.8956	32.2421	31.9154	31.9154	32.5689	33.3858	33.7125	33.5491	(39)

Average = Sum(39)m / 12 = 33.1679

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4842	0.4842	0.4796	0.4658	0.4634	0.4542	0.4496	0.4496	0.4588	0.4704	0.4750	0.4727	(40)
HLP (average)												0.4673	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2697 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day) 138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
										Total per year (kWh/year) = Sum(64)m =		2544.5466	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)													
	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains													
	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(75)

Solar gains	42.7730	92.6022	174.0550	301.5827	403.2921	419.0362	396.3745	305.8819	210.3213	112.3593	55.2465	35.7661	(83)
Total gains	589.1195	636.8057	701.3971	796.6307	867.1157	854.2796	814.4731	727.1958	647.6393	578.5722	556.7443	568.1110	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.0586	114.0586	115.1535	118.5680	119.1569	121.5721	122.8168	122.8168	120.3524	117.4076	116.2696	116.8358	
alpha	8.6039	8.6039	8.6769	8.9045	8.9438	9.1048	9.1878	9.1878	9.0235	8.8272	8.7513	8.7891	
util living area													
	0.8948	0.8436	0.7313	0.5425	0.3907	0.2944	0.2390	0.2721	0.4123	0.6468	0.8263	0.9072	(86)
MIT	20.8725	20.9227	20.9763	20.9982	20.9999	21.0000	21.0000	21.0000	20.9999	20.9935	20.9463	20.8626	(87)
Th 2	20.5354	20.5354	20.5396	20.5523	20.5544	20.5630	20.5672	20.5672	20.5587	20.5481	20.5438	20.5460	(88)
util rest of house													
	0.8819	0.8278	0.7122	0.5242	0.3738	0.2779	0.2221	0.2531	0.3901	0.6222	0.8073	0.8955	(89)
MIT 2	20.3944	20.4521	20.5153	20.5506	20.5544	20.5629	20.5672	20.5672	20.5586	20.5421	20.4880	20.3930	(90)
Living area fraction										fLA = Living area / (4) =		0.4060	(91)
MIT	20.5885	20.6432	20.7024	20.7323	20.7353	20.7404	20.7429	20.7429	20.7378	20.7254	20.6741	20.5837	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5885	20.6432	20.7024	20.7323	20.7353	20.7404	20.7429	20.7429	20.7378	20.7254	20.6741	20.5837	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8835	0.8316	0.7190	0.5316	0.3807	0.2846	0.2290	0.2608	0.3991	0.6319	0.8129	0.8965	(94)
Useful gains	520.4584	529.5388	504.3299	423.4968	330.0802	243.1167	186.4792	189.6703	258.4856	365.5902	452.5648	509.3180	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	573.5183	561.6502	514.0764	424.2235	330.1165	243.1185	186.4794	189.6709	258.5247	368.0921	474.4733	566.4323	(97)
Space heating kWh													
	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930	(98a)
Space heating requirement - total per year (kWh/year)												128.9856	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												128.9856	
Space heating per m2										(98c) / (4) =		1.8172	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)

Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.2338	-25.6721	-43.2787	-56.7922	-66.2633	-62.5005	-62.0252	-54.7629	-44.4553	-31.3120	-18.0261	-13.1034	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.9401	-7.5576	-17.9590	-32.2559	-44.6250	-44.1582	-44.2385	-34.3187	-23.1566	-11.4806	-4.2984	-2.3312	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	128.9856	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2544.5466	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	154.2094	(230a)
Total electricity for the above, kWh/year	154.2094	(231)
Electricity for lighting (calculated in Appendix L)	163.7369	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-762.7453	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2228.7332	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	128.9856	25.1600	32.4528	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	25.1600	640.2079	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	25.1600	38.7991	(249)
Energy for lighting	163.7369	25.1600	41.1962	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.4255	25.1600	-124.1459	
PV Unit electricity exported	-269.3198	5.8100	-15.6475	
Total			-139.7933	(252)
Total energy cost			612.8627	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	128.9856	0.1600	20.6366	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			380.1811	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.4255	0.1320	-65.1384	
PV Unit electricity exported	-269.3198	0.1229	-33.1064	
Total			-98.2448	(269)
Total CO2, kg/year			326.9594	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	128.9856	1.5921	205.3619	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	1.5225	3874.0629	(278)
Space and water heating			4079.4248	(279)
Pumps, fans and electric keep-hot	154.2094	1.5128	233.2880	(281)
Energy for lighting	163.7369	1.5338	251.1452	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.4255	1.4878	-734.0970	
PV Unit electricity exported	-269.3198	0.4511	-121.5003	
Total			-855.5973	(283)
Total Primary energy kWh/year			3708.2608	(286)

SAP 10 EPC IMPROVEMENTS

Unit 425 L02_Copy

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 80
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£753	£753	£0
Space heating	£71	£71	£0
Water heating	£640	£640	£0
Lighting	£41	£41	£0
Generated (PV)	-£140	-£140	£0
Total cost of fuels	£613	£613	£0
Total cost of uses	£612	£612	£0
Delivered energy	31 kWh/m²	31 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	52 kWh/m²	52 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14111.0700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		198.8035 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.8660 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.2026	16.0392	15.8758	15.0589	14.8955	14.0786	14.0786	13.9153	14.4054	14.8955	15.2223	15.5490	(38)
Heat transfer coeff	34.2027	34.0393	33.8759	33.0590	32.8956	32.0787	32.0787	31.9154	32.4055	32.8956	33.2224	33.5491	(39)
Average = Sum(39)m / 12 =												33.0182	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4819	0.4796	0.4773	0.4658	0.4634	0.4519	0.4519	0.4496	0.4565	0.4634	0.4681	0.4727	(40)
HLP (average)												0.4652	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.2697 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)

Hot water usage for baths

26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)

Hot water usage for other uses

37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)

Average daily hot water use (litres/day)		138.3203 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
									Total per year (kWh/year) = Sum(64)m =		2544.5466	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast				11.8100	11.2829	0.6300	0.8270	0.7700	48.1118	(75)
Solar gains	48.1118	97.9329	176.4440	289.7718	389.5101	415.2590	388.4663	309.6898	214.9998	119.6818	60.5371	39.2905	(83)
Total gains	594.4583	642.1364	703.7861	784.8198	853.3337	850.5024	806.5649	731.0038	652.3178	585.8947	562.0348	571.6354	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.6034	115.1535	115.7089	118.5680	119.1569	122.1913	122.1913	122.8168	120.9592	119.1569	117.9849	116.8358	
alpha	8.6402	8.6769	8.7139	8.9045	8.9438	9.1461	9.1461	9.1878	9.0639	8.9438	8.8657	8.7891	
util living area	0.8775	0.8131	0.6885	0.5091	0.3585	0.2414	0.1750	0.2008	0.3428	0.5819	0.7916	0.8914	(86)
MIT	20.8955	20.9454	20.9859	20.9990	21.0000	21.0000	21.0000	21.0000	21.0000	20.9975	20.9643	20.8857	(87)
Th 2	20.5375	20.5396	20.5417	20.5523	20.5544	20.5651	20.5651	20.5672	20.5608	20.5544	20.5502	20.5460	(88)
util rest of house	0.8633	0.7958	0.6685	0.4904	0.3413	0.2250	0.1577	0.1819	0.3210	0.5575	0.7712	0.8782	(89)
MIT 2	20.4234	20.4818	20.5277	20.5514	20.5544	20.5651	20.5651	20.5672	20.5608	20.5523	20.5139	20.4203	(90)
Living area fraction									fLA = Living area / (4) =			0.4060	(91)
MIT	20.6151	20.6700	20.7137	20.7331	20.7353	20.7417	20.7417	20.7429	20.7391	20.7331	20.6968	20.6093	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6151	20.6700	20.7137	20.7331	20.7353	20.7417	20.7417	20.7429	20.7391	20.7331	20.6968	20.6093	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8657	0.8008	0.6760	0.4979	0.3483	0.2316	0.1647	0.1896	0.3298	0.5673	0.7780	0.8801	(94)
Useful gains	514.6438	514.2072	475.7927	390.7925	297.2070	197.0168	132.8596	138.6063	215.1380	332.4041	437.2668	503.1190	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	558.0190	536.7995	481.5030	391.1911	297.2225	197.0170	132.8596	138.6063	215.1442	333.3337	451.7174	550.5165	(97)
Space heating kWh	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(98a)
Space heating requirement - total per year (kWh/year)												98.3601	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												98.3601	
Space heating per m2										(98c) / (4) =		1.3857	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	32.2712	15.1820	4.2485	0.2870	0.0115	0.0000	0.0000	0.0000	0.0000	0.6917	10.4045	35.2637	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972	(231)
Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.8048	-26.6478	-43.2456	-54.4944	-64.0203	-61.6099	-60.6290	-54.7463	-44.7493	-32.6681	-19.3717	-14.1696	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.4726	-8.1139	-18.0130	-29.9352	-41.8274	-42.9674	-42.3587	-34.2994	-23.4325	-12.3679	-4.8722	-2.6645	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												98.3601	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2544.5466	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	154.2094	(230a)
Total electricity for the above, kWh/year	154.2094	(231)
Electricity for lighting (calculated in Appendix L)	163.7369	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-757.4814	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2203.3717	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	98.3601	16.4900	16.2196	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	16.4900	419.5957	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	16.4900	25.4291	(249)
Energy for lighting	163.7369	16.4900	27.0002	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.1568	16.4900	-81.3216	
PV Unit electricity exported	-264.3246	5.5900	-14.7757	
Total			-96.0973	(252)
Total energy cost			392.1474	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2172	(257)
SAP value		80.2689	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	98.3601	0.1606	15.7950	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			375.3396	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.1568	0.1323	-65.2544	
PV Unit electricity exported	-264.3246	0.1234	-32.6244	
Total			-97.8788	(269)
Total CO2, kg/year			322.4838	(272)
CO2 emissions per m2			4.5400	(273)
EI value			96.2741	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		70.9800 (1b)	x	2.4000 (2b)	=	170.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9800						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	170.3520	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.8100	1.2357	14.5941			(27)
External Wall 1	22.8100	11.8100	11.0000	0.1400	1.5400	14.0000	154.0000	(29a)
Total net area of external elements Aum(A, m2)			22.8100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.1341			(33)
Party Wall 1			52.6200	0.0000	0.0000	20.0000	1052.4000	(32)
Wall to corridor			15.5500	0.0000	0.0000	20.0000	311.0000	(32)
Party Floor 1			70.9800			80.0000	5678.4000	(32d)
Party Ceiling 1			70.9800			80.0000	5678.4000	(32b)
Internal Wall 1			137.4300			9.0000	1236.8700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 14111.0700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.8035 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.0900	0.0500	0.2545
E4 Jamb	13.9200	0.0500	0.6960
E7 Party floor between dwellings (in blocks of flats)	8.4500	0.0700	0.5915
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	25.2500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	1.8660 (36)
Point Thermal bridges (36a) =	0.0000
Total fabric heat loss (33) + (36) + (36a) =	18.0001 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.3659	16.3659	16.0392	15.0589	14.8955	14.2420	13.9153	13.9153	14.5688	15.3857	15.7124	15.5490	(38)
Heat transfer coeff	34.3660	34.3660	34.0393	33.0590	32.8956	32.2421	31.9154	31.9154	32.5689	33.3858	33.7125	33.5491	(39)
Average = Sum(39)m / 12 =												33.1679	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4842	0.4842	0.4796	0.4658	0.4634	0.4542	0.4496	0.4496	0.4588	0.4704	0.4750	0.4727	(40)
HLP (average)												0.4673	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2697 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.6277	84.3409	82.4658	78.8780	76.2303	73.2777	71.5994	73.4604	75.5003	78.6706	82.3354	85.2997	(42a)
Hot water usage for baths	26.9034	26.5038	25.9412	24.9038	24.1269	23.2656	22.8003	23.3590	23.9674	24.8891	25.9479	26.8124	(42b)
Hot water usage for other uses	37.8738	36.4966	35.1193	33.7421	32.3649	30.9876	30.9876	32.3649	33.7421	35.1193	36.4966	37.8738	(42c)
Average daily hot water use (litres/day)												138.3203	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.4049	147.3413	143.5263	137.5239	132.7222	127.5309	125.3873	129.1842	133.2098	138.6790	144.7798	149.9859	(44)
Energy conte	238.2046	209.8121	220.5946	188.2633	178.6695	156.8141	151.6451	159.9571	164.2610	188.1860	206.2654	234.8417	(45)
Energy content (annual)										Total = Sum(45)m =		2297.5146	
Distribution loss (46)m = 0.15 x (45)m	35.7307	31.4718	33.0892	28.2395	26.8004	23.5221	22.7468	23.9936	24.6391	28.2279	30.9398	35.2263	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225	(64)
									Total per year (kWh/year) = Sum(64)m =			2544.5466	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	95.9877	84.9228	90.1323	78.8408	76.1923	68.3839	67.2066	69.9704	70.8600	79.3565	84.8264	94.8695	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	136.1808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1787	20.5871	16.7425	12.6752	9.4748	7.9991	8.6433	11.2348	15.0794	19.1468	22.3471	23.8229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.8708	300.9617	293.1726	276.5905	255.6585	235.9854	222.8425	219.7515	227.5407	244.1228	265.0548	284.7279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	50.8878	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	-90.7872	(71)
Water heating gains (Table 5)	129.0157	126.3733	121.1456	109.5010	102.4090	94.9776	90.3315	94.0462	98.4166	106.6620	117.8145	127.5128	(72)
Total internal gains	546.3465	544.2035	527.3421	495.0480	463.8236	435.2434	418.0987	421.3140	437.3181	466.2129	501.4978	532.3449	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.8100	10.0309	0.6300	0.8270	0.7700	42.7730	(75)

Solar gains	42.7730	92.6022	174.0550	301.5827	403.2921	419.0362	396.3745	305.8819	210.3213	112.3593	55.2465	35.7661	(83)
Total gains	589.1195	636.8057	701.3971	796.6307	867.1157	854.2796	814.4731	727.1958	647.6393	578.5722	556.7443	568.1110	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	114.0586	114.0586	115.1535	118.5680	119.1569	121.5721	122.8168	122.8168	120.3524	117.4076	116.2696	116.8358	
alpha	8.6039	8.6039	8.6769	8.9045	8.9438	9.1048	9.1878	9.1878	9.0235	8.8272	8.7513	8.7891	
util living area	0.8948	0.8436	0.7313	0.5425	0.3907	0.2944	0.2390	0.2721	0.4123	0.6468	0.8263	0.9072	(86)
MIT	20.8725	20.9227	20.9763	20.9982	20.9999	21.0000	21.0000	21.0000	20.9999	20.9935	20.9463	20.8626	(87)
Th 2	20.5354	20.5354	20.5396	20.5523	20.5544	20.5630	20.5672	20.5672	20.5587	20.5481	20.5438	20.5460	(88)
util rest of house	0.8819	0.8278	0.7122	0.5242	0.3738	0.2779	0.2221	0.2531	0.3901	0.6222	0.8073	0.8955	(89)
MIT 2	20.3944	20.4521	20.5153	20.5506	20.5544	20.5629	20.5672	20.5672	20.5586	20.5421	20.4880	20.3930	(90)
Living area fraction										fLA = Living area / (4) =		0.4060	(91)
MIT	20.5885	20.6432	20.7024	20.7323	20.7353	20.7404	20.7429	20.7429	20.7378	20.7254	20.6741	20.5837	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5885	20.6432	20.7024	20.7323	20.7353	20.7404	20.7429	20.7429	20.7378	20.7254	20.6741	20.5837	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8835	0.8316	0.7190	0.5316	0.3807	0.2846	0.2290	0.2608	0.3991	0.6319	0.8129	0.8965	(94)
Useful gains	520.4584	529.5388	504.3299	423.4968	330.0802	243.1167	186.4792	189.6703	258.4856	365.5902	452.5648	509.3180	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	573.5183	561.6502	514.0764	424.2235	330.1165	243.1185	186.4794	189.6709	258.5247	368.0921	474.4733	566.4323	(97)
Space heating kWh	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930	(98a)
Space heating requirement - total per year (kWh/year)												128.9856	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												128.9856	
Space heating per m2											(98c) / (4) =	1.8172	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													

	39.4766	21.5788	7.2514	0.5232	0.0270	0.0000	0.0000	0.0000	0.0000	1.8614	15.7741	42.4930 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	259.1854	228.7625	241.5754	208.5673	199.6503	177.1181	172.6259	180.9379	184.5650	209.1668	226.5694	255.8225 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	13.0972	11.8298	13.0972	12.6747	13.0972	12.6747	13.0972	13.0972	12.6747	13.0972	12.6747	13.0972 (231)
Lighting	20.2881	16.2759	14.6546	10.7366	8.2933	6.7757	7.5654	9.8338	12.7731	16.7590	18.9293	20.8520 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-15.2338	-25.6721	-43.2787	-56.7922	-66.2633	-62.5005	-62.0252	-54.7629	-44.4553	-31.3120	-18.0261	-13.1034 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.9401	-7.5576	-17.9590	-32.2559	-44.6250	-44.1582	-44.2385	-34.3187	-23.1566	-11.4806	-4.2984	-2.3312 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	128.9856 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2544.5466 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	154.2094 (230a)
Total electricity for the above, kWh/year	154.2094 (231)
Electricity for lighting (calculated in Appendix L)	163.7369 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-762.7453 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2228.7332 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	128.9856	25.1600	32.4528	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	25.1600	640.2079	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	154.2094	25.1600	38.7991	(249)
Energy for lighting	163.7369	25.1600	41.1962	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.4255	25.1600	-124.1459	
PV Unit electricity exported	-269.3198	5.8100	-15.6475	
Total			-139.7933	(252)
Total energy cost			612.8627	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	128.9856	0.1600	20.6366	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2544.5466	0.1413	359.5446	(264)
Space and water heating			380.1811	(265)
Pumps, fans and electric keep-hot	154.2094	0.1387	21.3908	(267)
Energy for lighting	163.7369	0.1443	23.6323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.4255	0.1320	-65.1384	
PV Unit electricity exported	-269.3198	0.1229	-33.1064	
Total			-98.2448	(269)
Total CO2, kg/year			326.9594	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	128.9856	1.5921	205.3619	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2544.5466	1.5225	3874.0629	(278)
Space and water heating			4079.4248	(279)

Pumps, fans and electric keep-hot	154.2094	1.5128	233.2880	(281)
Energy for lighting	163.7369	1.5338	251.1452	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-493.4255	1.4878	-734.0970	
PV Unit electricity exported	-269.3198	0.4511	-121.5003	
Total			-855.5973	(283)
Total Primary energy kWh/year			3708.2608	(286)

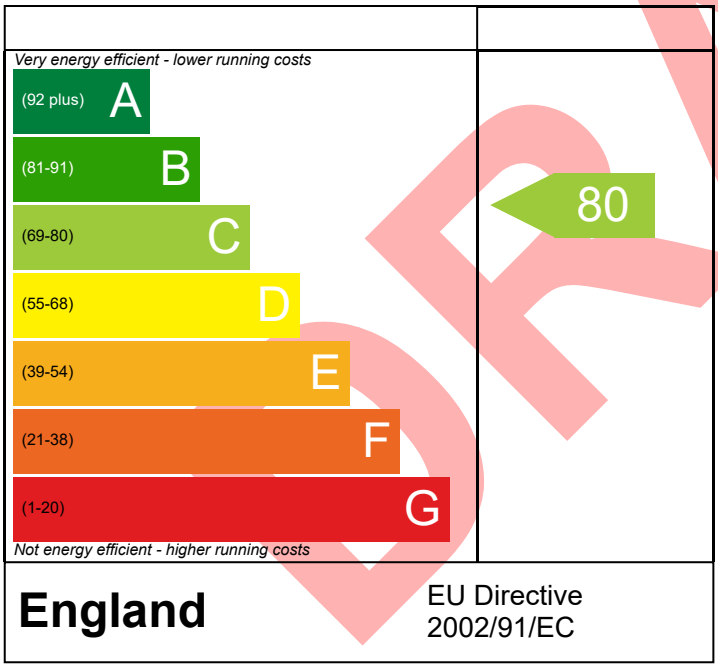
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	70.98 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

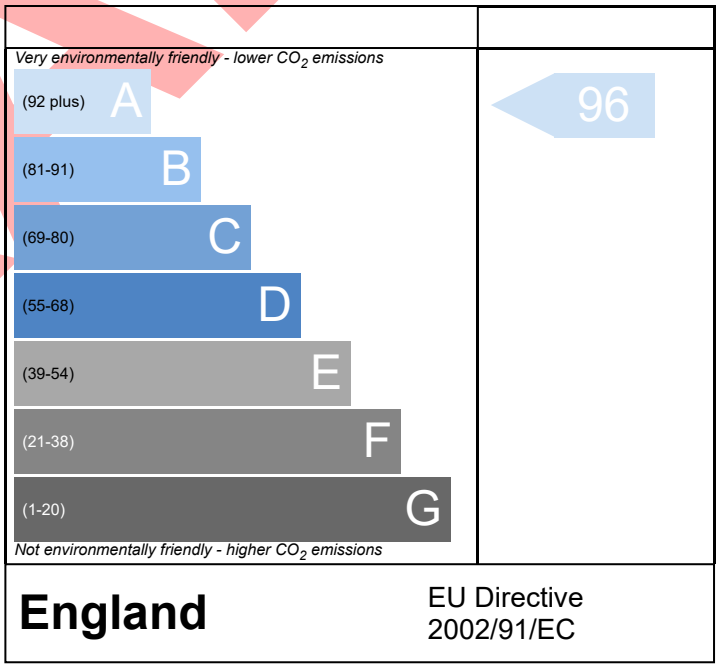
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:35

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, End-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	66 m^2
Site Reference	Unit 426 L02_Copy	Plot Reference	Unit 426 L02_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.14 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	5.32 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*60.16 kWh_{PE}/m^2*	
Dwelling primary energy	59.44 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*21.4 kWh/m^2*	
Dwelling fabric energy efficiency	21.6 kWh/m^2	FAIL

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SE (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	25.12	0.14 **(!)**
Party wall: Party Wall (1)	55.02	0 **(!)**
Party wall: Party Wall (2)	3.85	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SE, Opening Type 1	11.81	South East	0.83	1.3
NE, Opening Type 1	7.88	North East	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.86 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 426 L02_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 426 L02_Copy	**Prop Type Ref**	Unit 426 L02
Property			

SAP Rating	78 C	**DER**	5.32	**TER**	11.14
Environmental	96 A	**% DER < TER**			52.24
CO_2 Emissions (t/year)	0.36	**DFEE**	21.59	**TFEE**	21.38
Compliance Check	See BREL	**% DFEE < TFEE**			-0.98
% DPER < TPER	1.20	**DPER**	59.44	**TPER**	60.16

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.4100	(1b)	x 2.4000	(2b) =	159.3840	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.4100					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		159.3840	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.8100	19.6900	25.1200	0.1400	3.5168	14.0000	351.6800	(29a)
Total net area of external elements Aum(A, m2)			44.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.8485			(33)
Party Wall 1			55.0200	0.0000	0.0000	20.0000	1100.4000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.4100			80.0000	5312.8000	(32d)
Party Ceiling 1			66.4100			80.0000	5312.8000	(32b)
Internal Wall 1			140.4500			9.0000	1264.0500	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13418.7300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.0589 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240

E4 Jamb	23.2000	0.0500	1.1600	
E7 Party floor between dwellings (in blocks of flats)	16.5900	0.0700	1.1613	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	21.8000	0.0000	0.0000	
E16 Corner (normal)	5.4000	0.0900	0.4860	
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				3.5553 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	31.4038 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.9138	15.7461	15.5785	14.7402	14.5726	13.7343	13.7343	13.5667	14.0696	14.5726	14.9079	15.2432	(38)
Heat transfer coeff	47.3176	47.1500	46.9823	46.1441	45.9764	45.1382	45.1382	44.9705	45.4735	45.9764	46.3117	46.6470	(39)
Average = Sum(39)m / 12 =												46.1022	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7125	0.7100	0.7075	0.6948	0.6923	0.6797	0.6797	0.6772	0.6847	0.6923	0.6974	0.7024	(40)
HLP (average)												0.6942	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.1559	(42)
Hot water usage for mixer showers	83.0050	81.7576	79.9399	76.4620	73.8955	71.0332	69.4063	71.2103	73.1878	76.2609	79.8135	82.6870	(42a)
Hot water usage for baths	26.0831	25.6958	25.1503	24.1445	23.3913	22.5562	22.1051	22.6468	23.2366	24.1302	25.1567	25.9950	(42b)
Hot water usage for other uses	36.7088	35.3739	34.0390	32.7042	31.3693	30.0344	30.0344	31.3693	32.7042	34.0390	35.3739	36.7088	(42c)
Average daily hot water use (litres/day)												134.0826	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7969	142.8273	139.1292	133.3107	128.6561	123.6239	121.5459	125.2264	129.1285	134.4302	140.3441	145.3907	(44)
Energy conte	230.9067	203.3841	213.8364	182.4956	173.1958	152.0100	146.9993	155.0565	159.2284	182.4205	199.9459	227.6467	(45)
Energy content (annual)											Total = Sum(45)m =	2227.1258	
Distribution loss (46)m = 0.15 x (45)m	34.6360	30.5076	32.0755	27.3743	25.9794	22.8015	22.0499	23.2585	23.8843	27.3631	29.9919	34.1470	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
										Total per year (kWh/year) = Sum(64)m =		2474.1578	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	93.5611	82.7855	87.8852	76.9230	74.3722	66.7865	65.6619	68.3409	69.1866	77.4394	82.7252	92.4772	(65)

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5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7302	19.3006	15.6963	11.8831	8.8827	7.4992	8.1031	10.5328	14.1371	17.9502	20.9506	22.3341	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.7577	284.6815	277.3137	261.6285	241.8288	223.2199	210.7880	207.8643	215.2321	230.9172	250.7169	269.3258	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	(71)
Water heating gains (Table 5)	125.7542	123.1928	118.1253	106.8375	99.9627	92.7591	88.2552	91.8561	96.0926	104.0853	114.8961	124.2973	(72)
Total internal gains	522.4518	520.3846	504.3451	473.5589	443.8841	416.6880	400.3562	403.4629	418.6715	446.1625	479.7734	509.1670	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(75)
Southeast	11.8100	36.7938	0.6300	0.8270	0.7700	156.8932	(77)

Solar gains	188.9949	332.5911	483.3882	646.4144	767.3690	780.8797	744.9195	651.7680	539.3863	375.2206	228.3142	160.4838	(83)
Total gains	711.4468	852.9757	987.7333	1119.9732	1211.2531	1197.5676	1145.2757	1055.2309	958.0577	821.3831	708.0876	669.6508	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.7745	79.0546	79.3367	80.7780	81.0725	82.5781	82.5781	82.8860	81.9692	81.0725	80.4855	79.9070	
alpha	6.2516	6.2703	6.2891	6.3852	6.4048	6.5052	6.5052	6.5257	6.4646	6.4048	6.3657	6.3271	
util living area	0.9030	0.8075	0.6675	0.4956	0.3527	0.2412	0.1734	0.1960	0.3273	0.5744	0.8198	0.9213	(86)
MIT	20.6897	20.8522	20.9540	20.9930	20.9993	21.0000	21.0000	21.0000	20.9997	20.9866	20.8667	20.6491	(87)
Th 2	20.3298	20.3320	20.3342	20.3454	20.3476	20.3588	20.3588	20.3610	20.3543	20.3476	20.3432	20.3387	(88)
util rest of house	0.8881	0.7855	0.6410	0.4695	0.3281	0.2171	0.1481	0.1688	0.2968	0.5404	0.7950	0.9085	(89)
MIT 2	19.9885	20.1767	20.2890	20.3392	20.3471	20.3588	20.3588	20.3610	20.3541	20.3361	20.2070	19.9486	(90)
Living area fraction										fLA = Living area / (4) =		0.3439	(91)
MIT	20.2297	20.4090	20.5177	20.5640	20.5714	20.5793	20.5793	20.5808	20.5761	20.5598	20.4339	20.1896	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2297	20.4090	20.5177	20.5640	20.5714	20.5793	20.5793	20.5808	20.5761	20.5598	20.4339	20.1896	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8857	0.7881	0.6484	0.4782	0.3365	0.2254	0.1568	0.1782	0.3073	0.5516	0.7986	0.9054	(94)
Useful gains	630.1308	672.2506	640.4892	535.6178	407.6196	269.8816	179.6187	188.0104	294.3932	453.0509	565.4734	606.2927	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	753.7551	731.2498	658.5834	538.2263	407.8736	269.8945	179.6196	188.0124	294.4927	457.9172	617.5145	745.8656	(97)
Space heating kWh	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(98a)
Space heating requirement - total per year (kWh/year)												292.0855	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												292.0855	
Space heating per m2										(98c) / (4) =		4.3982	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5604	10.4416	11.5604	11.1874	11.5604	11.1874	11.5604	11.5604	11.1874	11.5604	11.1874	11.5604	(231)
Lighting	19.0203	15.2588	13.7389	10.0657	7.7750	6.3523	7.0926	9.2193	11.9749	15.7117	17.7464	19.5489	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.9020	-25.1650	-40.7355	-51.2571	-60.2242	-57.9694	-57.0463	-51.4863	-42.0498	-30.6941	-18.2779	-13.4134	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.0531	-7.3297	-16.5280	-27.6662	-38.7205	-39.7876	-39.2248	-31.7520	-21.6853	-11.4048	-4.3848	-2.3228	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

Space heating fuel - main system 1	292.0855	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2474.1578	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.1139	(230a)
Total electricity for the above, kWh/year	136.1139	(231)
Electricity for lighting (calculated in Appendix L)	153.5048	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-708.0805	(233)
Wind generation	0.0000	(234)

Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2347.7816	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	292.0855	16.4900	48.1649	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	16.4900	407.9886	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	136.1139	16.4900	22.4452	(249)
Energy for lighting	153.5048	16.4900	25.3129	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.2208	16.4900	-76.5500	
PV Unit electricity exported	-243.8596	5.5900	-13.6318	
Total			-90.1818	(252)
Total energy cost			413.7299	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.3369	(257)
SAP value		78.3290	
SAP rating (Section 12)		78	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	292.0855	0.1601	46.7656	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2474.1578	0.1413	349.5790	(264)
Space and water heating			396.3446	(265)
Pumps, fans and electric keep-hot	136.1139	0.1387	18.8807	(267)
Energy for lighting	153.5048	0.1443	22.1555	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.2208	0.1323	-61.4360	
PV Unit electricity exported	-243.8596	0.1232	-30.0483	
Total			-91.4843	(269)
Total CO2, kg/year			345.8964	(272)
CO2 emissions per m2			5.2100	(273)
EI value			95.8397	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		66.4100 (1b)	x	2.4000 (2b)	=	159.3840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.4100						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.3840	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.8100	19.6900	25.1200	0.1400	3.5168	14.0000	351.6800	(29a)
Total net area of external elements Aum(A, m2)			44.8100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.8485			(33)
Party Wall 1			55.0200	0.0000	0.0000	20.0000	1100.4000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.4100			80.0000	5312.8000	(32d)
Party Ceiling 1			66.4100			80.0000	5312.8000	(32b)
Internal Wall 1			140.4500			9.0000	1264.0500	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13418.7300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 202.0589 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.5900	0.0700	1.1613
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	21.8000	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.5553 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 31.4038 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.0814	16.0814	15.7461	14.7402	14.5726	13.9020	13.5667	13.5667	14.2373	15.0755	15.4108	15.2432	(38)
Heat transfer coeff	47.4853	47.4853	47.1500	46.1441	45.9764	45.3058	44.9705	44.9705	45.6411	46.4794	46.8147	46.6470	(39)

Average = Sum(39)m / 12 = 46.2558

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7150	0.7150	0.7100	0.6948	0.6923	0.6822	0.6772	0.6772	0.6873	0.6999	0.7049	0.7024	(40)
HLP (average)												0.6965	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1559 (42)
Hot water usage for mixer showers

83.0050	81.7576	79.9399	76.4620	73.8955	71.0332	69.4063	71.2103	73.1878	76.2609	79.8135	82.6870	(42a)

Hot water usage for baths

26.0831	25.6958	25.1503	24.1445	23.3913	22.5562	22.1051	22.6468	23.2366	24.1302	25.1567	25.9950	(42b)

Hot water usage for other uses

36.7088	35.3739	34.0390	32.7042	31.3693	30.0344	30.0344	31.3693	32.7042	34.0390	35.3739	36.7088	(42c)

Average daily hot water use (litres/day) 134.0826 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7969	142.8273	139.1292	133.3107	128.6561	123.6239	121.5459	125.2264	129.1285	134.4302	140.3441	145.3907	(44)
Energy conte	230.9067	203.3841	213.8364	182.4956	173.1958	152.0100	146.9993	155.0565	159.2284	182.4205	199.9459	227.6467	(45)
Energy content (annual)										Total = Sum(45)m =		2227.1258	
Distribution loss (46)m = 0.15 x (45)m	34.6360	30.5076	32.0755	27.3743	25.9794	22.8015	22.0499	23.2585	23.8843	27.3631	29.9919	34.1470	(46)

Water storage loss:
Store volume 143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.6768 (55)
Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
									Total per year (kWh/year) = Sum(64)m =		2474.1578	(64)
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

93.5611	82.7855	87.8852	76.9230	74.3722	66.7865	65.6619	68.3409	69.1866	77.4394	82.7252	92.4772	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	21.7302	19.3006	15.6963	11.8831	8.8827	7.4992	8.1031	10.5328	14.1371	17.9502	20.9506	22.3341	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	281.7577	284.6815	277.3137	261.6285	241.8288	223.2199	210.7880	207.8643	215.2321	230.9172	250.7169	269.3258	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	(71)

Water heating gains (Table 5)

	125.7542	123.1928	118.1253	106.8375	99.9627	92.7591	88.2552	91.8561	96.0926	104.0853	114.8961	124.2973	(72)

Total internal gains

	522.4518	520.3846	504.3451	473.5589	443.8841	416.6880	400.3562	403.4629	418.6715	446.1625	479.7734	509.1670	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(75)
Southeast	11.8100	33.4622	0.6300	0.8270	0.7700	142.6869	(77)

Solar gains	171.2264	321.1940	487.0707	684.6820	805.1181	796.7968	769.3033	653.9832	538.3810	359.9515	212.5016	148.7415	(83)
Total gains	693.6782	841.5786	991.4157	1158.2409	1249.0022	1213.4847	1169.6595	1057.4461	957.0525	806.1140	692.2750	657.9085	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.4964	78.4964	79.0546	80.7780	81.0725	82.2725	82.8860	82.8860	81.6681	80.1952	79.6208	79.9070	
alpha	6.2331	6.2331	6.2703	6.3852	6.4048	6.4848	6.5257	6.5257	6.4445	6.3463	6.3081	6.3271	
util living area	0.9197	0.8349	0.7014	0.5179	0.3787	0.2911	0.2345	0.2636	0.3905	0.6359	0.8514	0.9346	(86)
MIT	20.6348	20.8103	20.9354	20.9903	20.9988	20.9998	21.0000	20.9999	20.9989	20.9734	20.8218	20.5957	(87)
Th 2	20.3276	20.3276	20.3320	20.3454	20.3476	20.3566	20.3610	20.3610	20.3521	20.3409	20.3365	20.3387	(88)
util rest of house	0.9069	0.8149	0.6763	0.4930	0.3548	0.2672	0.2100	0.2365	0.3598	0.6026	0.8294	0.9237	(89)
MIT 2	19.9210	20.1249	20.2669	20.3365	20.3466	20.3564	20.3610	20.3610	20.3513	20.3170	20.1505	19.8839	(90)
Living area fraction									fLA = Living area / (4) =			0.3439	(91)
MIT	20.1665	20.3606	20.4968	20.5613	20.5709	20.5777	20.5808	20.5807	20.5740	20.5428	20.3814	20.1287	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1665	20.3606	20.4968	20.5613	20.5709	20.5777	20.5808	20.5807	20.5740	20.5428	20.3814	20.1287	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9035	0.8159	0.6826	0.5012	0.3630	0.2754	0.2184	0.2458	0.3703	0.6129	0.8309	0.9199	(94)
Useful gains	626.7471	686.6584	676.6978	580.5582	453.3870	334.1970	255.4576	259.9424	354.4406	494.0662	575.2427	605.2281	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	772.4183	762.6420	702.3835	584.2461	453.8286	334.2536	255.4673	259.9631	354.8138	503.9653	645.1697	766.3484	(97)
Space heating kWh	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(98a)
Space heating requirement - total per year (kWh/year)												359.1203	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												359.1203	
Space heating per m2										(98c) / (4) =		5.4076	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
Efficiency of water heater												100.0000	(216)

(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5604	10.4416	11.5604	11.1874	11.5604	11.1874	11.5604	11.5604	11.1874	11.5604	11.1874	11.5604	(231)
Lighting	19.0203	15.2588	13.7389	10.0657	7.7750	6.3523	7.0926	9.2193	11.9749	15.7117	17.7464	19.5489	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.4219	-24.2665	-40.8039	-53.4428	-62.3485	-58.8113	-58.3661	-51.5020	-41.7727	-29.4443	-17.0276	-12.4092	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.5668	-6.7960	-16.4400	-29.7978	-41.3079	-40.8915	-40.9673	-31.7699	-21.4298	-10.5575	-3.8409	-2.0189	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	359.1203	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2474.1578	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.1139	(230a)
Total electricity for the above, kWh/year	136.1139	(231)
Electricity for lighting (calculated in Appendix L)	153.5048	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-713.0011	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2409.8957	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	359.1203	25.1600	90.3547	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	25.1600	622.4981	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	136.1139	25.1600	34.2463	(249)
Energy for lighting	153.5048	25.1600	38.6218	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.6169	25.1600	-116.8976	
PV Unit electricity exported	-248.3842	5.8100	-14.4311	
Total			-131.3287	(252)
Total energy cost			654.3921	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	359.1203	0.1596	57.3260	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2474.1578	0.1413	349.5790	(264)
Space and water heating			406.9051	(265)
Pumps, fans and electric keep-hot	136.1139	0.1387	18.8807	(267)
Energy for lighting	153.5048	0.1443	22.1555	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.6169	0.1320	-61.3475	
PV Unit electricity exported	-248.3842	0.1227	-30.4782	
Total			-91.8258	(269)
Total CO2, kg/year			356.1155	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	359.1203	1.5908	571.2751	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	1.5225	3766.8228	(278)
Space and water heating			4338.0979	(279)
Pumps, fans and electric keep-hot	136.1139	1.5128	205.9132	(281)
Energy for lighting	153.5048	1.5338	235.4508	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.6169	1.4879	-691.2826	
PV Unit electricity exported	-248.3842	0.4503	-111.8546	
Total			-803.1371	(283)
Total Primary energy kWh/year			3976.3248	(286)

SAP 10 EPC IMPROVEMENTS

Unit 426 L02_Copy

Current energy efficiency rating: C 78
Current environmental impact rating: A 96

N Solar water heating	Not applicable
U Solar photovoltaic panels	Not applicable
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 78
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£786	£786	£0
Space heating	£125	£125	£0
Water heating	£622	£622	£0
Lighting	£39	£39	£0
Generated (PV)	-£131	-£131	£0
Total cost of fuels	£655	£655	£0
Total cost of uses	£655	£655	£0
Delivered energy	36 kWh/m²	36 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	60 kWh/m²	60 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.4100 (1b)	x	2.4000 (2b)	=	159.3840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.4100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.3840	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3026	0.2994	0.2962	0.2802	0.2771	0.2611	0.2611	0.2579	0.2675	0.2771	0.2834	0.2898	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.8100	19.6900	25.1200	0.1400	3.5168	14.0000	351.6800	(29a)
Total net area of external elements Aum(A, m2)			44.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.8485			(33)
Party Wall 1			55.0200	0.0000	0.0000	20.0000	1100.4000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.4100			80.0000	5312.8000	(32d)
Party Ceiling 1			66.4100			80.0000	5312.8000	(32b)
Internal Wall 1			140.4500			9.0000	1264.0500	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13418.7300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 202.0589 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240	
E4 Jamb	23.2000	0.0500	1.1600	
E7 Party floor between dwellings (in blocks of flats)	16.5900	0.0700	1.1613	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	21.8000	0.0000	0.0000	
E16 Corner (normal)	5.4000	0.0900	0.4860	
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.5553 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 31.4038 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.9138	15.7461	15.5785	14.7402	14.5726	13.7343	13.7343	13.5667	14.0696	14.5726	14.9079	15.2432	(38)
Heat transfer coeff	47.3176	47.1500	46.9823	46.1441	45.9764	45.1382	45.1382	44.9705	45.4735	45.9764	46.3117	46.6470	(39)
Average = Sum(39)m / 12 =												46.1022	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7125	0.7100	0.7075	0.6948	0.6923	0.6797	0.6797	0.6772	0.6847	0.6923	0.6974	0.7024	(40)
HLP (average)												0.6942	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1559 (42)
Hot water usage for mixer showers

83.0050	81.7576	79.9399	76.4620	73.8955	71.0332	69.4063	71.2103	73.1878	76.2609	79.8135	82.6870	(42a)

Hot water usage for baths

26.0831	25.6958	25.1503	24.1445	23.3913	22.5562	22.1051	22.6468	23.2366	24.1302	25.1567	25.9950	(42b)

Hot water usage for other uses

36.7088	35.3739	34.0390	32.7042	31.3693	30.0344	30.0344	31.3693	32.7042	34.0390	35.3739	36.7088	(42c)

Average daily hot water use (litres/day) 134.0826 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7969	142.8273	139.1292	133.3107	128.6561	123.6239	121.5459	125.2264	129.1285	134.4302	140.3441	145.3907	(44)
Energy conte	230.9067	203.3841	213.8364	182.4956	173.1958	152.0100	146.9993	155.0565	159.2284	182.4205	199.9459	227.6467	(45)
Energy content (annual)										Total = Sum(45)m =		2227.1258	
Distribution loss (46)m = 0.15 x (45)m	34.6360	30.5076	32.0755	27.3743	25.9794	22.8015	22.0499	23.2585	23.8843	27.3631	29.9919	34.1470	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
									Total per year (kWh/year) = Sum(64)m =			2474.1578	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	93.5611	82.7855	87.8852	76.9230	74.3722	66.7865	65.6619	68.3409	69.1866	77.4394	82.7252	92.4772	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7302	19.3006	15.6963	11.8831	8.8827	7.4992	8.1031	10.5328	14.1371	17.9502	20.9506	22.3341	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.7577	284.6815	277.3137	261.6285	241.8288	223.2199	210.7880	207.8643	215.2321	230.9172	250.7169	269.3258	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	(71)
Water heating gains (Table 5)													

	125.7542	123.1928	118.1253	106.8375	99.9627	92.7591	88.2552	91.8561	96.0926	104.0853	114.8961	124.2973	(72)
Total internal gains													
	522.4518	520.3846	504.3451	473.5589	443.8841	416.6880	400.3562	403.4629	418.6715	446.1625	479.7734	509.1670	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.8800	11.2829	0.6300	0.8270	0.7700	32.1017	(75)
Southeast	11.8100	36.7938	0.6300	0.8270	0.7700	156.8932	(77)

Solar gains	188.9949	332.5911	483.3882	646.4144	767.3690	780.8797	744.9195	651.7680	539.3863	375.2206	228.3142	160.4838	(83)
Total gains	711.4468	852.9757	987.7333	1119.9732	1211.2531	1197.5676	1145.2757	1055.2309	958.0577	821.3831	708.0876	669.6508	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.7745	79.0546	79.3367	80.7780	81.0725	82.5781	82.5781	82.8860	81.9692	81.0725	80.4855	79.9070	
alpha	6.2516	6.2703	6.2891	6.3852	6.4048	6.5052	6.5052	6.5257	6.4646	6.4048	6.3657	6.3271	
util living area													
	0.9030	0.8075	0.6675	0.4956	0.3527	0.2412	0.1734	0.1960	0.3273	0.5744	0.8198	0.9213	(86)
MIT	20.6897	20.8522	20.9540	20.9930	20.9993	21.0000	21.0000	21.0000	20.9997	20.9866	20.8667	20.6491	(87)
Th 2	20.3298	20.3320	20.3342	20.3454	20.3476	20.3588	20.3588	20.3610	20.3543	20.3476	20.3432	20.3387	(88)
util rest of house													
	0.8881	0.7855	0.6410	0.4695	0.3281	0.2171	0.1481	0.1688	0.2968	0.5404	0.7950	0.9085	(89)
MIT 2	19.9885	20.1767	20.2890	20.3392	20.3471	20.3588	20.3588	20.3610	20.3541	20.3361	20.2070	19.9486	(90)
Living area fraction										fLA = Living area / (4) =		0.3439	(91)
MIT	20.2297	20.4090	20.5177	20.5640	20.5714	20.5793	20.5793	20.5808	20.5761	20.5598	20.4339	20.1896	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2297	20.4090	20.5177	20.5640	20.5714	20.5793	20.5793	20.5808	20.5761	20.5598	20.4339	20.1896	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8857	0.7881	0.6484	0.4782	0.3365	0.2254	0.1568	0.1782	0.3073	0.5516	0.7986	0.9054	(94)
Useful gains	630.1308	672.2506	640.4892	535.6178	407.6196	269.8816	179.6187	188.0104	294.3932	453.0509	565.4734	606.2927	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	753.7551	731.2498	658.5834	538.2263	407.8736	269.8945	179.6196	188.0124	294.4927	457.9172	617.5145	745.8656	(97)
Space heating kWh													
	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(98a)
Space heating requirement - total per year (kWh/year)												292.0855	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												292.0855	
Space heating per m2											(98c) / (4) =	4.3982	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	91.9765	39.6475	13.4621	1.8781	0.1889	0.0000	0.0000	0.0000	0.0000	3.6205	37.4696	103.8422	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5604	10.4416	11.5604	11.1874	11.5604	11.1874	11.5604	11.5604	11.1874	11.5604	11.1874	11.5604	(231)
Lighting	19.0203	15.2588	13.7389	10.0657	7.7750	6.3523	7.0926	9.2193	11.9749	15.7117	17.7464	19.5489	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.9020	-25.1650	-40.7355	-51.2571	-60.2242	-57.9694	-57.0463	-51.4863	-42.0498	-30.6941	-18.2779	-13.4134	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													

(233b)m	-3.0531	-7.3297	-16.5280	-27.6662	-38.7205	-39.7876	-39.2248	-31.7520	-21.6853	-11.4048	-4.3848	-2.3228	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	292.0855	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2474.1578	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	136.1139	(230a)
Total electricity for the above, kWh/year	136.1139	(231)
Electricity for lighting (calculated in Appendix L)	153.5048	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-708.0805	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2347.7816	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	292.0855	16.4900	48.1649	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	16.4900	407.9886	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	136.1139	16.4900	22.4452	(249)
Energy for lighting	153.5048	16.4900	25.3129	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.2208	16.4900	-76.5500	
PV Unit electricity exported	-243.8596	5.5900	-13.6318	
Total			-90.1818	(252)
Total energy cost			413.7299	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.3369	(257)
SAP value		78.3290	
SAP rating (Section 12)		78	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	292.0855	0.1601	46.7656	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2474.1578	0.1413	349.5790	(264)
Space and water heating			396.3446	(265)
Pumps, fans and electric keep-hot	136.1139	0.1387	18.8807	(267)
Energy for lighting	153.5048	0.1443	22.1555	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.2208	0.1323	-61.4360	
PV Unit electricity exported	-243.8596	0.1232	-30.0483	
Total			-91.4843	(269)
Total CO2, kg/year			345.8964	(272)
CO2 emissions per m2			5.2100	(273)
EI value			95.8397	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		66.4100 (1b)	x	2.4000 (2b)	=	159.3840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.4100						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	159.3840	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3058	0.3058	0.2994	0.2802	0.2771	0.2643	0.2579	0.2579	0.2707	0.2866	0.2930	0.2898	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.6900	1.2357	24.3317			(27)
External Wall 1	44.8100	19.6900	25.1200	0.1400	3.5168	14.0000	351.6800	(29a)
Total net area of external elements Aum(A, m2)			44.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.8485			(33)
Party Wall 1			55.0200	0.0000	0.0000	20.0000	1100.4000	(32)
Wall to corridor			3.8500	0.0000	0.0000	20.0000	77.0000	(32)
Party Floor 1			66.4100			80.0000	5312.8000	(32d)
Party Ceiling 1			66.4100			80.0000	5312.8000	(32b)
Internal Wall 1			140.4500			9.0000	1264.0500	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13418.7300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		202.0589 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4800	0.0500	0.4240
E4 Jamb	23.2000	0.0500	1.1600
E7 Party floor between dwellings (in blocks of flats)	16.5900	0.0700	1.1613
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	21.8000	0.0000	0.0000
E16 Corner (normal)	5.4000	0.0900	0.4860
E17 Corner (inverted - internal area greater than external area)	2.7000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.5553 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	31.4038 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.0814	16.0814	15.7461	14.7402	14.5726	13.9020	13.5667	13.5667	14.2373	15.0755	15.4108	15.2432	(38)
Heat transfer coeff	47.4853	47.4853	47.1500	46.1441	45.9764	45.3058	44.9705	44.9705	45.6411	46.4794	46.8147	46.6470	(39)
Average = Sum(39)m / 12 =												46.2558	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7150	0.7150	0.7100	0.6948	0.6923	0.6822	0.6772	0.6772	0.6873	0.6999	0.7049	0.7024	(40)
HLP (average)												0.6965	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1559	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
83.0050	81.7576	79.9399	76.4620	73.8955	71.0332	69.4063	71.2103	73.1878	76.2609	79.8135	82.6870	(42a)

Hot water usage for baths

26.0831	25.6958	25.1503	24.1445	23.3913	22.5562	22.1051	22.6468	23.2366	24.1302	25.1567	25.9950	(42b)

Hot water usage for other uses

36.7088	35.3739	34.0390	32.7042	31.3693	30.0344	30.0344	31.3693	32.7042	34.0390	35.3739	36.7088	(42c)

Average daily hot water use (litres/day)	134.0826 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7969	142.8273	139.1292	133.3107	128.6561	123.6239	121.5459	125.2264	129.1285	134.4302	140.3441	145.3907	(44)
Energy conte	230.9067	203.3841	213.8364	182.4956	173.1958	152.0100	146.9993	155.0565	159.2284	182.4205	199.9459	227.6467	(45)
Energy content (annual)										Total = Sum(45)m =		2227.1258	
Distribution loss (46)m = 0.15 x (45)m	34.6360	30.5076	32.0755	27.3743	25.9794	22.8015	22.0499	23.2585	23.8843	27.3631	29.9919	34.1470	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)

Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage													
	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
										Total per year (kWh/year) = Sum(64)m =		2474.1578	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	93.5611	82.7855	87.8852	76.9230	74.3722	66.7865	65.6619	68.3409	69.1866	77.4394	82.7252	92.4772	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	129.3551	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.7302	19.3006	15.6963	11.8831	8.8827	7.4992	8.1031	10.5328	14.1371	17.9502	20.9506	22.3341	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	281.7577	284.6815	277.3137	261.6285	241.8288	223.2199	210.7880	207.8643	215.2321	230.9172	250.7169	269.3258	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	50.0914	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	-86.2367	(71)
Water heating gains (Table 5)													
	125.7542	123.1928	118.1253	106.8375	99.9627	92.7591	88.2552	91.8561	96.0926	104.0853	114.8961	124.2973	(72)
Total internal gains													
	522.4518	520.3846	504.3451	473.5589	443.8841	416.6880	400.3562	403.4629	418.6715	446.1625	479.7734	509.1670	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.8800	10.0309	0.6300	0.8270	0.7700	28.5395	(75)
Southeast	11.8100	33.4622	0.6300	0.8270	0.7700	142.6869	(77)

Solar gains	171.2264	321.1940	487.0707	684.6820	805.1181	796.7968	769.3033	653.9832	538.3810	359.9515	212.5016	148.7415	(83)
Total gains	693.6782	841.5786	991.4157	1158.2409	1249.0022	1213.4847	1169.6595	1057.4461	957.0525	806.1140	692.2750	657.9085	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.4964	78.4964	79.0546	80.7780	81.0725	82.2725	82.8860	82.8860	81.6681	80.1952	79.6208	79.9070	
alpha	6.2331	6.2331	6.2703	6.3852	6.4048	6.4848	6.5257	6.5257	6.4445	6.3463	6.3081	6.3271	
util living area													
	0.9197	0.8349	0.7014	0.5179	0.3787	0.2911	0.2345	0.2636	0.3905	0.6359	0.8514	0.9346	(86)
MIT	20.6348	20.8103	20.9354	20.9903	20.9988	20.9998	21.0000	20.9999	20.9989	20.9734	20.8218	20.5957	(87)
Th 2	20.3276	20.3276	20.3320	20.3454	20.3476	20.3566	20.3610	20.3610	20.3521	20.3409	20.3365	20.3387	(88)
util rest of house													
	0.9069	0.8149	0.6763	0.4930	0.3548	0.2672	0.2100	0.2365	0.3598	0.6026	0.8294	0.9237	(89)
MIT 2	19.9210	20.1249	20.2669	20.3365	20.3466	20.3564	20.3610	20.3610	20.3513	20.3170	20.1505	19.8839	(90)
Living area fraction										fLA = Living area / (4) =		0.3439	(91)
MIT	20.1665	20.3606	20.4968	20.5613	20.5709	20.5777	20.5808	20.5807	20.5740	20.5428	20.3814	20.1287	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1665	20.3606	20.4968	20.5613	20.5709	20.5777	20.5808	20.5807	20.5740	20.5428	20.3814	20.1287	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9035	0.8159	0.6826	0.5012	0.3630	0.2754	0.2184	0.2458	0.3703	0.6129	0.8309	0.9199	(94)
Useful gains	626.7471	686.6584	676.6978	580.5582	453.3870	334.1970	255.4576	259.9424	354.4406	494.0662	575.2427	605.2281	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	772.4183	762.6420	702.3835	584.2461	453.8286	334.2536	255.4673	259.9631	354.8138	503.9653	645.1697	766.3484	(97)
Space heating kWh													
	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(98a)
Space heating requirement - total per year (kWh/year)												359.1203	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												359.1203	
Space heating per m2											(98c) / (4) =	5.4076	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	108.3794	51.0610	19.1101	2.6553	0.3285	0.0000	0.0000	0.0000	0.0000	7.3649	50.3475	119.8735	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	251.8875	222.3345	234.8172	202.7996	194.1766	172.3140	167.9801	176.0373	179.5324	203.4013	220.2499	248.6275	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.5604	10.4416	11.5604	11.1874	11.5604	11.1874	11.5604	11.5604	11.1874	11.5604	11.1874	11.5604	(231)
Lighting	19.0203	15.2588	13.7389	10.0657	7.7750	6.3523	7.0926	9.2193	11.9749	15.7117	17.7464	19.5489	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.4219	-24.2665	-40.8039	-53.4428	-62.3485	-58.8113	-58.3661	-51.5020	-41.7727	-29.4443	-17.0276	-12.4092	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.5668	-6.7960	-16.4400	-29.7978	-41.3079	-40.8915	-40.9673	-31.7699	-21.4298	-10.5575	-3.8409	-2.0189	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												359.1203	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2474.1578	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)													
mechanical ventilation fans (SFP = 0.7000)												136.1139	(230a)
Total electricity for the above, kWh/year												136.1139	(231)
Electricity for lighting (calculated in Appendix L)												153.5048	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-713.0011	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2409.8957	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	359.1203	25.1600	90.3547	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	25.1600	622.4981	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	136.1139	25.1600	34.2463	(249)
Energy for lighting	153.5048	25.1600	38.6218	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.6169	25.1600	-116.8976	
PV Unit electricity exported	-248.3842	5.8100	-14.4311	
Total			-131.3287	(252)
Total energy cost			654.3921	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	359.1203	0.1596	57.3260	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2474.1578	0.1413	349.5790	(264)
Space and water heating			406.9051	(265)
Pumps, fans and electric keep-hot	136.1139	0.1387	18.8807	(267)
Energy for lighting	153.5048	0.1443	22.1555	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.6169	0.1320	-61.3475	
PV Unit electricity exported	-248.3842	0.1227	-30.4782	
Total			-91.8258	(269)
Total CO2, kg/year			356.1155	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	359.1203	1.5908	571.2751	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2474.1578	1.5225	3766.8228	(278)
Space and water heating			4338.0979	(279)
Pumps, fans and electric keep-hot	136.1139	1.5128	205.9132	(281)
Energy for lighting	153.5048	1.5338	235.4508	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-464.6169	1.4879	-691.2826	
PV Unit electricity exported	-248.3842	0.4503	-111.8546	
Total			-803.1371	(283)
Total Primary energy kWh/year			3976.3248	(286)

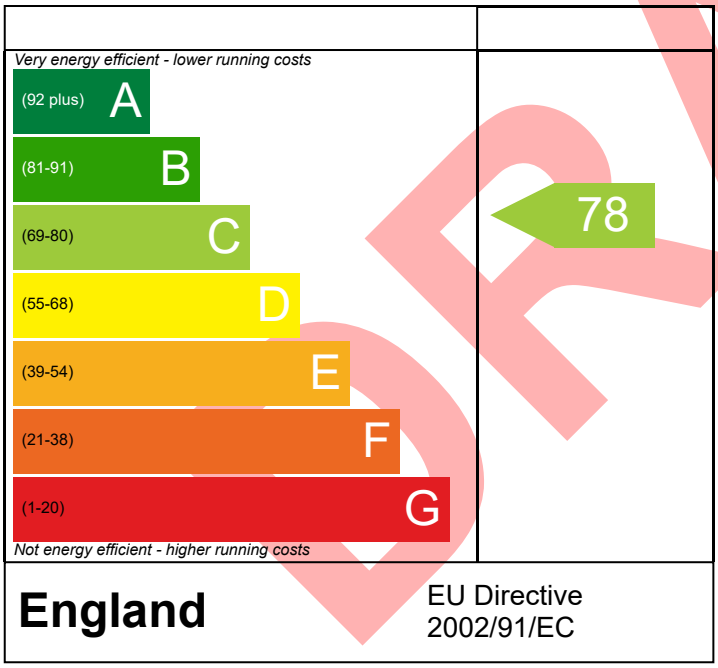
Predicted Energy Assessment

Dwelling type:	Flat, End-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	66.41 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

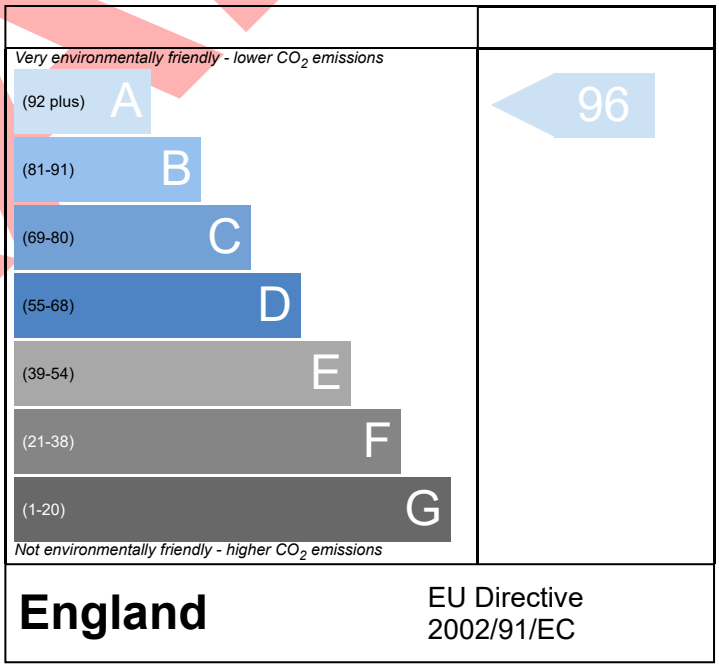
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Wed 01 May 2024 10:35:36

Project Information			
Assessed By	Cairn Pearson	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027323	Assessment Date	2024-05-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	51 m^2
Site Reference	Unit 427 L02_Copy	Plot Reference	Unit 427 L02_Copy
Address			

Client Details	
Name	Test
Company	Test
Address	Test, Test, Test

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.15 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	5.41 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*60.59 kWh$_{PE}$/m^2*	
Dwelling primary energy	60.93 kWh$_{PE}$/m^2	FAIL
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*12.8 kWh/m^2*	
Dwelling fabric energy efficiency	11.8 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.14	Walls (1) (0.14)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	SW (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	8.18	0.14 **(!)**
Party wall: Party Wall (1)	46.44	0 **(!)**
Party wall: Party Wall (2)	16.06	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
SW, Opening Type 1	7.88	South West	0.83	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	143 litres
Declared heat loss	1.128 kWh/day
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model	MRXBOXAB-ECO3	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.66 kWp
Orientation	South West
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Unit 427 L02_Copy	**Issued on Date**	01/05/2024
Assessment Reference	Unit 427 L02_Copy	**Prop Type Ref**	Unit 427 L02
Property			

SAP Rating	80 C	**DER**	5.41	**TER**	11.15
Environmental	96 A	**% DER < TER**			51.48
CO_2 Emissions (t/year)	0.28	**DFEE**	11.85	**TFEE**	12.80
Compliance Check	See BREL	**% DFEE < TFEE**			7.47
% DPER < TPER	-0.56	**DPER**	60.93	**TPER**	60.59

Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.1700	(1b)	x 2.4000	(2b) =	122.8080	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.1700					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		122.8080	(5)

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2. Ventilation rate

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	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												72.0000	(23c)
Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	16.0600	7.8800	8.1800	0.1400	1.1452	14.0000	114.5200	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.8828			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			16.0600	0.0000	0.0000	20.0000	321.2000	(32)
Party Floor 1			51.1700			80.0000	4093.6000	(32d)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			79.3800			9.0000	714.4200	(32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		10266.1400	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							200.6281	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695

E4 Jamb	9.2800	0.0500	0.4640	
E7 Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165	
E18 Party wall between dwellings	5.4000	0.0600	0.3240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.3740 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 12.2568 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.6805	11.5628	11.4450	10.8561	10.7383	10.1494	10.1494	10.0316	10.3850	10.7383	10.9739	11.2094	(38)
Heat transfer coeff	23.9374	23.8196	23.7018	23.1129	22.9951	22.4062	22.4062	22.2885	22.6418	22.9951	23.2307	23.4663	(39)
Average = Sum(39)m / 12 =												23.0835	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4678	0.4655	0.4632	0.4517	0.4494	0.4379	0.4379	0.4356	0.4425	0.4494	0.4540	0.4586	(40)
HLP (average)												0.4511	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7246 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.0608	71.9628	70.3629	67.3017	65.0426	62.5233	61.0913	62.6791	64.4197	67.1247	70.2516	72.7809	(42a)
Hot water usage for baths	22.9731	22.6319	22.1514	21.2656	20.6022	19.8667	19.4694	19.9465	20.4660	21.2530	22.1571	22.8954	(42b)
Hot water usage for other uses	32.2915	31.1172	29.9430	28.7688	27.5945	26.4203	26.4203	27.5945	28.7688	29.9430	31.1172	32.2915	(42c)
Average daily hot water use (litres/day)												118.0151	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.3253	125.7119	122.4573	117.3360	113.2393	108.8102	106.9810	110.2201	113.6544	118.3207	123.5260	127.9677	(44)
Energy conte	203.2359	179.0121	188.2123	160.6271	152.4419	133.7949	129.3842	136.4755	140.1472	160.5600	175.9854	200.3665	(45)
Energy content (annual)										Total = Sum(45)m =		1960.2433	
Distribution loss (46)m = 0.15 x (45)m	30.4854	26.8518	28.2318	24.0941	22.8663	20.0692	19.4076	20.4713	21.0221	24.0840	26.3978	30.0550	(46)
Water storage loss:													
Store volume												143.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1280	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6768	(55)
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
										Total per year (kWh/year) = Sum(64)m =		2207.2753	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	84.3606	74.6819	79.3652	69.6517	67.4716	60.7300	59.8049	62.1628	62.8422	70.1708	74.7583	83.4065	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.6375	15.6655	12.7400	9.6450	7.2098	6.0868	6.5770	8.5490	11.4745	14.5695	17.0047	18.1277	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	224.2868	226.6142	220.7492	208.2634	192.5023	177.6891	167.7930	165.4656	171.3306	183.8164	199.5774	214.3906	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	(71)
Water heating gains (Table 5)	113.3879	111.1337	106.6737	96.7385	90.6876	84.3472	80.3829	83.5521	87.2808	94.3157	103.8310	112.1055	(72)
Total internal gains	436.8760	434.9772	421.7267	396.2107	371.9635	349.6869	336.3167	339.1305	351.6496	374.2653	401.9770	426.1877	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	104.6841	178.3157	243.9793	302.3022	338.6036	336.1550	324.0893	297.0068	264.1780	197.0768	125.3874	89.5877	(83)
Total gains	541.5600	613.2928	665.7060	698.5129	710.5671	685.8419	660.4060	636.1373	615.8276	571.3421	527.3644	515.7754	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	119.1319	119.7210	120.3159	123.3815	124.0134	127.2729	127.2729	127.9454	125.9487	124.0134	122.7559	121.5237	
alpha	8.9421	8.9814	9.0211	9.2254	9.2676	9.4849	9.4849	9.5297	9.3966	9.2676	9.1837	9.1016	
util living area													
	0.7247	0.6218	0.5156	0.4003	0.3010	0.2091	0.1493	0.1612	0.2537	0.4185	0.6097	0.7476	(86)
MIT	20.9788	20.9938	20.9988	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9999	20.9959	20.9748	(87)
Th 2	20.5504	20.5526	20.5547	20.5653	20.5674	20.5781	20.5781	20.5802	20.5738	20.5674	20.5632	20.5589	(88)
util rest of house													
	0.7074	0.6052	0.4999	0.3860	0.2870	0.1953	0.1350	0.1465	0.2380	0.4011	0.5911	0.7306	(89)
MIT 2	20.5284	20.5463	20.5535	20.5652	20.5674	20.5781	20.5781	20.5802	20.5738	20.5673	20.5592	20.5326	(90)
Living area fraction										fLA = Living area / (4) =		0.5576	(91)
MIT	20.7795	20.7958	20.8017	20.8076	20.8086	20.8133	20.8133	20.8143	20.8114	20.8085	20.8027	20.7792	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7795	20.7958	20.8017	20.8076	20.8086	20.8133	20.8133	20.8143	20.8114	20.8085	20.8027	20.7792	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7163	0.6142	0.5086	0.3940	0.2948	0.2030	0.1429	0.1547	0.2468	0.4108	0.6013	0.7392	(94)
Useful gains	387.8953	376.7106	338.5994	275.1878	209.4519	139.2173	94.4049	98.3874	151.9589	234.7094	317.0931	381.2564	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	394.4762	378.6309	338.9773	275.2187	209.4537	139.2174	94.4049	98.3874	151.9591	234.7458	318.3236	389.0512	(97)
Space heating kWh													
	4.8961	1.2904	0.2812	0.0223	0.0013	0.0000	0.0000	0.0000	0.0000	0.0271	0.8860	5.7993	(98a)
Space heating requirement - total per year (kWh/year)												13.2037	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	4.8961	1.2904	0.2812	0.0223	0.0013	0.0000	0.0000	0.0000	0.0000	0.0271	0.8860	5.7993	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												13.2037	
Space heating per m2											(98c) / (4) =	0.2580	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	4.8961	1.2904	0.2812	0.0223	0.0013	0.0000	0.0000	0.0000	0.0000	0.0271	0.8860	5.7993	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	4.8961	1.2904	0.2812	0.0223	0.0013	0.0000	0.0000	0.0000	0.0000	0.0271	0.8860	5.7993	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9074	8.0454	8.9074	8.6201	8.9074	8.6201	8.9074	8.9074	8.6201	8.9074	8.6201	8.9074	(231)
Lighting	15.4380	12.3850	11.1513	8.1699	6.3107	5.1559	5.7568	7.4829	9.7196	12.7526	14.4040	15.8671	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.1420	-19.3585	-31.6479	-40.1405	-47.3610	-45.6598	-44.9395	-40.4814	-32.9522	-23.8996	-14.0606	-10.2289	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4049	-5.5792	-12.2985	-20.4286	-28.5733	-29.3630	-28.9430	-23.3991	-15.9608	-8.4088	-3.3317	-1.8477	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	13.2037	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2207.2753	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	104.8780	(230a)
Total electricity for the above, kWh/year	104.8780	(231)
Electricity for lighting (calculated in Appendix L)	124.5936	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-543.4106	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1906.5401	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	13.2037	16.4900	2.1773	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	16.4900	363.9797	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	104.8780	16.4900	17.2944	(249)
Energy for lighting	124.5936	16.4900	20.5455	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-362.8720	16.4900	-59.8376	
PV Unit electricity exported	-180.5386	5.5900	-10.0921	
Total			-69.9297	(252)
Total energy cost			334.0672	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2505	(257)
SAP value		79.7288	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	13.2037	0.1616	2.1337	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2207.2753	0.1413	311.7942	(264)
Space and water heating			313.9279	(265)
Pumps, fans and electric keep-hot	104.8780	0.1387	14.5479	(267)
Energy for lighting	124.5936	0.1443	17.9827	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-362.8720	0.1322	-47.9727	
PV Unit electricity exported	-180.5386	0.1235	-22.2897	
Total			-70.2624	(269)
Total CO2, kg/year			276.1961	(272)
CO2 emissions per m2			5.4000	(273)
EI value			96.1516	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		51.1700 (1b)	x	2.4000 (2b)	=	122.8080	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.1700						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	122.8080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.0000 (23c)

Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	16.0600	7.8800	8.1800	0.1400	1.1452	14.0000	114.5200	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.8828			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			16.0600	0.0000	0.0000	20.0000	321.2000	(32)
Party Floor 1			51.1700			80.0000	4093.6000	(32d)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			79.3800			9.0000	714.4200	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 10266.1400 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 200.6281 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4	Jamb	9.2800	0.0500	0.4640
E7	Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165
E18	Party wall between dwellings	5.4000	0.0600	0.3240
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.3740 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 12.2568 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.7983	11.7983	11.5628	10.8561	10.7383	10.2672	10.0316	10.0316	10.5027	11.0916	11.3272	11.2094	(38)
Heat transfer coeff	24.0552	24.0552	23.8196	23.1129	22.9951	22.5240	22.2885	22.2885	22.7596	23.3485	23.5840	23.4663	(39)

Average = Sum(39)m / 12 = 23.1914

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4701	0.4701	0.4655	0.4517	0.4494	0.4402	0.4356	0.4356	0.4448	0.4563	0.4609	0.4586	(40)
HLP (average)												0.4532	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7246 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.0608	71.9628	70.3629	67.3017	65.0426	62.5233	61.0913	62.6791	64.4197	67.1247	70.2516	72.7809	(42a)
Hot water usage for baths	22.9731	22.6319	22.1514	21.2656	20.6022	19.8667	19.4694	19.9465	20.4660	21.2530	22.1571	22.8954	(42b)
Hot water usage for other uses	32.2915	31.1172	29.9430	28.7688	27.5945	26.4203	26.4203	27.5945	28.7688	29.9430	31.1172	32.2915	(42c)

Average daily hot water use (litres/day) 118.0151 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.3253	125.7119	122.4573	117.3360	113.2393	108.8102	106.9810	110.2201	113.6544	118.3207	123.5260	127.9677	(44)
Energy conte	203.2359	179.0121	188.2123	160.6271	152.4419	133.7949	129.3842	136.4755	140.1472	160.5600	175.9854	200.3665	(45)
Energy content (annual)										Total = Sum(45)m =		1960.2433	
Distribution loss (46)m = 0.15 x (45)m	30.4854	26.8518	28.2318	24.0941	22.8663	20.0692	19.4076	20.4713	21.0221	24.0840	26.3978	30.0550	(46)

Water storage loss:

Store volume 143.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.1280 (48)

Temperature factor from Table 2b 0.6000 (49)

Enter (49) or (54) in (55) 0.6768 (55)

Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
										Total per year (kWh/year) = Sum(64)m =		2207.2753	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	84.3606	74.6819	79.3652	69.6517	67.4716	60.7300	59.8049	62.1628	62.8422	70.1708	74.7583	83.4065	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	17.6375	15.6655	12.7400	9.6450	7.2098	6.0868	6.5770	8.5490	11.4745	14.5695	17.0047	18.1277	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	224.2868	226.6142	220.7492	208.2634	192.5023	177.6891	167.7930	165.4656	171.3306	183.8164	199.5774	214.3906	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	(71)
Water heating gains (Table 5)													
	113.3879	111.1337	106.6737	96.7385	90.6876	84.3472	80.3829	83.5521	87.2808	94.3157	103.8310	112.1055	(72)
Total internal gains													
	436.8760	434.9772	421.7267	396.2107	371.9635	349.6869	336.3167	339.1305	351.6496	374.2653	401.9770	426.1877	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(79)

Solar gains	95.2051	173.0844	247.4999	322.5774	357.6553	345.0938	336.8383	300.1802	265.5901	190.1488	117.1921	83.3220	(83)
Total gains	532.0811	608.0616	669.2266	718.7881	729.6188	694.7807	673.1549	639.3107	617.2397	564.4141	519.1691	509.5097	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	118.5486	118.5486	119.7210	123.3815	124.0134	126.6073	127.9454	127.9454	125.2970	122.1367	120.9168	121.5237	
alpha	8.9032	8.9032	8.9814	9.2254	9.2676	9.4405	9.5297	9.5297	9.3531	9.1424	9.0611	9.1016	
util living area													
	0.7538	0.6550	0.5470	0.4212	0.3246	0.2529	0.2020	0.2162	0.3024	0.4672	0.6492	0.7740	(86)
MIT	20.9702	20.9899	20.9978	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9996	20.9926	20.9661	(87)
Th 2	20.5483	20.5483	20.5526	20.5653	20.5674	20.5760	20.5802	20.5802	20.5717	20.5611	20.5568	20.5589	(88)
util rest of house													
	0.7369	0.6382	0.5313	0.4072	0.3110	0.2391	0.1881	0.2015	0.2866	0.4491	0.6302	0.7576	(89)
MIT 2	20.5170	20.5380	20.5504	20.5651	20.5674	20.5760	20.5802	20.5802	20.5717	20.5607	20.5495	20.5230	(90)
Living area fraction										fLA = Living area / (4) =		0.5576	(91)
MIT	20.7697	20.7900	20.7999	20.8075	20.8086	20.8124	20.8143	20.8143	20.8105	20.8054	20.7965	20.7701	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7697	20.7900	20.7999	20.8075	20.8086	20.8124	20.8143	20.8143	20.8105	20.8054	20.7965	20.7701	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7453	0.6472	0.5400	0.4150	0.3186	0.2468	0.1958	0.2097	0.2954	0.4592	0.6405	0.7655	(94)
Useful gains	396.5380	393.5486	361.3857	298.2777	232.4448	171.4613	131.8200	134.0489	182.3141	259.1802	332.5508	390.0548	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	405.8027	396.6690	362.0545	298.3300	232.4487	171.4615	131.8201	134.0489	182.3155	259.2946	334.8115	400.5712	(97)
Space heating kWh													
	6.8930	2.0969	0.4976	0.0377	0.0029	0.0000	0.0000	0.0000	0.0000	0.0851	1.6276	7.8241	(98a)
Space heating requirement - total per year (kWh/year)												19.0650	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	6.8930	2.0969	0.4976	0.0377	0.0029	0.0000	0.0000	0.0000	0.0000	0.0851	1.6276	7.8241	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												19.0650	
Space heating per m2										(98c) / (4) =		0.3726	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	6.8930	2.0969	0.4976	0.0377	0.0029	0.0000	0.0000	0.0000	0.0000	0.0851	1.6276	7.8241	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	6.8930	2.0969	0.4976	0.0377	0.0029	0.0000	0.0000	0.0000	0.0000	0.0851	1.6276	7.8241	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9074	8.0454	8.9074	8.6201	8.9074	8.6201	8.9074	8.9074	8.6201	8.9074	8.6201	8.9074	(231)

Lighting	15.4380	12.3850	11.1513	8.1699	6.3107	5.1559	5.7568	7.4829	9.7196	12.7526	14.4040	15.8671	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.9944	-18.6173	-31.6417	-41.8588	-49.0561	-46.3351	-45.9986	-40.4939	-32.7321	-22.8868	-13.0643	-9.4500	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.0435	-5.2214	-12.2897	-22.0235	-30.4942	-30.1810	-30.2340	-23.4124	-15.7721	-7.8122	-2.9511	-1.6227	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	19.0650	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2207.2753	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	104.8780	(230a)
Total electricity for the above, kWh/year	104.8780	(231)
Electricity for lighting (calculated in Appendix L)	124.5936	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-547.1869	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1908.6251	(238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	19.0650	25.1600	4.7968	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	25.1600	555.3505	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	104.8780	25.1600	26.3873	(249)
Energy for lighting	124.5936	25.1600	31.3478	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1291	25.1600	-91.3633	
PV Unit electricity exported	-184.0578	5.8100	-10.6938	
Total			-102.0570	(252)
Total energy cost			515.8253	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	19.0650	0.1612	3.0737	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2207.2753	0.1413	311.7942	(264)
Space and water heating			314.8679	(265)
Pumps, fans and electric keep-hot	104.8780	0.1387	14.5479	(267)
Energy for lighting	124.5936	0.1443	17.9827	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1291	0.1319	-47.8936	
PV Unit electricity exported	-184.0578	0.1230	-22.6361	
Total			-70.5297	(269)
Total CO2, kg/year			276.8688	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	19.0650	1.5966	30.4390	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	1.5223	3360.2168	(278)
Space and water heating			3390.6558	(279)
Pumps, fans and electric keep-hot	104.8780	1.5128	158.6595	(281)
Energy for lighting	124.5936	1.5338	191.1059	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1291	1.4873	-540.0823	
PV Unit electricity exported	-184.0578	0.4513	-83.0740	
Total			-623.1563	(283)
Total Primary energy kWh/year			3117.2649	(286)

SAP 10 EPC IMPROVEMENTS

Unit 427 L02_Copy

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: C 80
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 540 TEST (28 Mar 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£618	£618	£0
Space heating	£31	£31	£0
Water heating	£555	£555	£0
Lighting	£31	£31	£0
Generated (PV)	-£102	-£102	£0
Total cost of fuels	£516	£516	£0
Total cost of uses	£515	£515	£0
Delivered energy	37 kWh/m²	37 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	61 kWh/m²	61 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.1700 (1b)	x	2.4000 (2b)	=	122.8080	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.1700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	122.8080	(5)

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2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		72.0000 (23c)

Effective ac	0.2882	0.2853	0.2824	0.2679	0.2650	0.2504	0.2504	0.2475	0.2562	0.2650	0.2708	0.2766	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	16.0600	7.8800	8.1800	0.1400	1.1452	14.0000	114.5200	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.8828			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			16.0600	0.0000	0.0000	20.0000	321.2000	(32)
Party Floor 1			51.1700			80.0000	4093.6000	(32d)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			79.3800			9.0000	714.4200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10266.1400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		200.6281 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.3740 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	12.2568 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.6805	11.5628	11.4450	10.8561	10.7383	10.1494	10.1494	10.0316	10.3850	10.7383	10.9739	11.2094	(38)
Heat transfer coeff	23.9374	23.8196	23.7018	23.1129	22.9951	22.4062	22.4062	22.2885	22.6418	22.9951	23.2307	23.4663	(39)
Average = Sum(39)m / 12 =												23.0835	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4678	0.4655	0.4632	0.4517	0.4494	0.4379	0.4379	0.4356	0.4425	0.4494	0.4540	0.4586	(40)
HLP (average)												0.4511	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.7246 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.0608	71.9628	70.3629	67.3017	65.0426	62.5233	61.0913	62.6791	64.4197	67.1247	70.2516	72.7809	(42a)

Hot water usage for baths

22.9731	22.6319	22.1514	21.2656	20.6022	19.8667	19.4694	19.9465	20.4660	21.2530	22.1571	22.8954	(42b)

Hot water usage for other uses

32.2915	31.1172	29.9430	28.7688	27.5945	26.4203	26.4203	27.5945	28.7688	29.9430	31.1172	32.2915	(42c)

Average daily hot water use (litres/day)		118.0151 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.3253	125.7119	122.4573	117.3360	113.2393	108.8102	106.9810	110.2201	113.6544	118.3207	123.5260	127.9677	(44)
Energy conte	203.2359	179.0121	188.2123	160.6271	152.4419	133.7949	129.3842	136.4755	140.1472	160.5600	175.9854	200.3665	(45)
Energy content (annual)										Total = Sum(45)m =		1960.2433	

Distribution loss (46)m = 0.15 x (45)m

30.4854	26.8518	28.2318	24.0941	22.8663	20.0692	19.4076	20.4713	21.0221	24.0840	26.3978	30.0550	(46)

Water storage loss:		
Store volume		143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.1280 (48)
Temperature factor from Table 2b		0.6000 (49)
Enter (49) or (54) in (55)		0.6768 (55)

Total storage loss

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)

If cylinder contains dedicated solar storage

20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)

	Total per year (kWh/year) = Sum(64)m =	2207.2753 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000 (64a)

Heat gains from water heating, kWh/month

84.3606	74.6819	79.3652	69.6517	67.4716	60.7300	59.8049	62.1628	62.8422	70.1708	74.7583	83.4065	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.6375	15.6655	12.7400	9.6450	7.2098	6.0868	6.5770	8.5490	11.4745	14.5695	17.0047	18.1277	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	224.2868	226.6142	220.7492	208.2634	192.5023	177.6891	167.7930	165.4656	171.3306	183.8164	199.5774	214.3906	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	(71)
Water heating gains (Table 5)	113.3879	111.1337	106.6737	96.7385	90.6876	84.3472	80.3829	83.5521	87.2808	94.3157	103.8310	112.1055	(72)
Total internal gains	436.8760	434.9772	421.7267	396.2107	371.9635	349.6869	336.3167	339.1305	351.6496	374.2653	401.9770	426.1877	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	36.7938	0.6300	0.8270	0.7700	104.6841	(79)

Solar gains	104.6841	178.3157	243.9793	302.3022	338.6036	336.1550	324.0893	297.0068	264.1780	197.0768	125.3874	89.5877 (83)
Total gains	541.5600	613.2928	665.7060	698.5129	710.5671	685.8419	660.4060	636.1373	615.8276	571.3421	527.3644	515.7754 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	119.1319	119.7210	120.3159	123.3815	124.0134	127.2729	127.2729	127.9454	125.9487	124.0134	122.7559	121.5237	
alpha	8.9421	8.9814	9.0211	9.2254	9.2676	9.4849	9.4849	9.5297	9.3966	9.2676	9.1837	9.1016	
util living area	0.7247	0.6218	0.5156	0.4003	0.3010	0.2091	0.1493	0.1612	0.2537	0.4185	0.6097	0.7476	(86)
MIT	20.9788	20.9938	20.9988	20.9999	21.0000	21.0000	21.0000	21.0000	21.0000	20.9999	20.9959	20.9748	(87)
Th 2	20.5504	20.5526	20.5547	20.5653	20.5674	20.5781	20.5781	20.5802	20.5738	20.5674	20.5632	20.5589	(88)
util rest of house	0.7074	0.6052	0.4999	0.3860	0.2870	0.1953	0.1350	0.1465	0.2380	0.4011	0.5911	0.7306	(89)
MIT 2	20.5284	20.5463	20.5535	20.5652	20.5674	20.5781	20.5781	20.5802	20.5738	20.5673	20.5592	20.5326	(90)
Living area fraction									fLA = Living area / (4) =			0.5576	(91)
MIT	20.7795	20.7958	20.8017	20.8076	20.8086	20.8133	20.8133	20.8143	20.8114	20.8085	20.8027	20.7792	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7795	20.7958	20.8017	20.8076	20.8086	20.8133	20.8133	20.8143	20.8114	20.8085	20.8027	20.7792	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7163	0.6142	0.5086	0.3940	0.2948	0.2030	0.1429	0.1547	0.2468	0.4108	0.6013	0.7392	(94)
Useful gains	387.8953	376.7106	338.5994	275.1878	209.4519	139.2173	94.4049	98.3874	151.9589	234.7094	317.0931	381.2564	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	394.4762	378.6309	338.9773	275.2187	209.4537	139.2174	94.4049	98.3874	151.9591	234.7458	318.3236	389.0512	(97)
Space heating kWh	4.8961	1.2904	0.2812	0.0223	0.0013	0.0000	0.0000	0.0000	0.0000	0.0271	0.8860	5.7993	(98a)
Space heating requirement - total per year (kWh/year)												13.2037	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	4.8961	1.2904	0.2812	0.0223	0.0013	0.0000	0.0000	0.0000	0.0000	0.0271	0.8860	5.7993	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												13.2037	
Space heating per m2											(98c) / (4) =	0.2580	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	4.8961	1.2904	0.2812	0.0223	0.0013	0.0000	0.0000	0.0000	0.0000	0.0271	0.8860	5.7993	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	4.8961	1.2904	0.2812	0.0223	0.0013	0.0000	0.0000	0.0000	0.0000	0.0271	0.8860	5.7993	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9074	8.0454	8.9074	8.6201	8.9074	8.6201	8.9074	8.9074	8.6201	8.9074	8.6201	8.9074	(231)
Lighting	15.4380	12.3850	11.1513	8.1699	6.3107	5.1559	5.7568	7.4829	9.7196	12.7526	14.4040	15.8671	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.1420	-19.3585	-31.6479	-40.1405	-47.3610	-45.6598	-44.9395	-40.4814	-32.9522	-23.8996	-14.0606	-10.2289	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.4049	-5.5792	-12.2985	-20.4286	-28.5733	-29.3630	-28.9430	-23.3991	-15.9608	-8.4088	-3.3317	-1.8477	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												13.2037	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2207.2753	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)	104.8780	(230a)
Total electricity for the above, kWh/year	104.8780	(231)
Electricity for lighting (calculated in Appendix L)	124.5936	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-543.4106	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1906.5401	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	13.2037	16.4900	2.1773	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	16.4900	363.9797	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	104.8780	16.4900	17.2944	(249)
Energy for lighting	124.5936	16.4900	20.5455	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-362.8720	16.4900	-59.8376	
PV Unit electricity exported	-180.5386	5.5900	-10.0921	
Total			-69.9297	(252)
Total energy cost			334.0672	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2505	(257)
SAP value		79.7288	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	13.2037	0.1616	2.1337	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2207.2753	0.1413	311.7942	(264)
Space and water heating			313.9279	(265)
Pumps, fans and electric keep-hot	104.8780	0.1387	14.5479	(267)
Energy for lighting	124.5936	0.1443	17.9827	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-362.8720	0.1322	-47.9727	
PV Unit electricity exported	-180.5386	0.1235	-22.2897	
Total			-70.2624	(269)
Total CO2, kg/year			276.1961	(272)
CO2 emissions per m2			5.4000	(273)
EI value			96.1516	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		51.1700	(1b)	x 2.4000	(2b) =	122.8080	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.1700						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		122.8080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate	0.1511	0.1511	0.1453	0.1279	0.1250	0.1133	0.1075	0.1075	0.1192	0.1337	0.1395	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2911	0.2911	0.2853	0.2679	0.2650	0.2533	0.2475	0.2475	0.2592	0.2737	0.2795	0.2766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.8800	1.2357	9.7376			(27)
External Wall 1	16.0600	7.8800	8.1800	0.1400	1.1452	14.0000	114.5200	(29a)
Total net area of external elements Aum(A, m2)			16.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	10.8828			(33)
Party Wall 1			46.4400	0.0000	0.0000	20.0000	928.8000	(32)
Wall to corridor			16.0600	0.0000	0.0000	20.0000	321.2000	(32)
Party Floor 1			51.1700			80.0000	4093.6000	(32d)
Party Ceiling 1			51.1700			80.0000	4093.6000	(32b)
Internal Wall 1			79.3800			9.0000	714.4200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 10266.1400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	200.6281 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	3.3900	0.0500	0.1695
E4 Jamb	9.2800	0.0500	0.4640
E7 Party floor between dwellings (in blocks of flats)	5.9500	0.0700	0.4165
E18 Party wall between dwellings	5.4000	0.0600	0.3240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.1500	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	1.3740 (36)
Point Thermal bridges (36a) =	0.0000
Total fabric heat loss (33) + (36) + (36a) =	12.2568 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.7983	11.7983	11.5628	10.8561	10.7383	10.2672	10.0316	10.0316	10.5027	11.0916	11.3272	11.2094	(38)
Heat transfer coeff	24.0552	24.0552	23.8196	23.1129	22.9951	22.5240	22.2885	22.2885	22.7596	23.3485	23.5840	23.4663	(39)
Average = Sum(39)m / 12 =												23.1914	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4701	0.4701	0.4655	0.4517	0.4494	0.4402	0.4356	0.4356	0.4448	0.4563	0.4609	0.4586	(40)
HLP (average)												0.4532	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7246 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.0608	71.9628	70.3629	67.3017	65.0426	62.5233	61.0913	62.6791	64.4197	67.1247	70.2516	72.7809	(42a)
Hot water usage for baths	22.9731	22.6319	22.1514	21.2656	20.6022	19.8667	19.4694	19.9465	20.4660	21.2530	22.1571	22.8954	(42b)
Hot water usage for other uses	32.2915	31.1172	29.9430	28.7688	27.5945	26.4203	26.4203	27.5945	28.7688	29.9430	31.1172	32.2915	(42c)
Average daily hot water use (litres/day)												118.0151	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.3253	125.7119	122.4573	117.3360	113.2393	108.8102	106.9810	110.2201	113.6544	118.3207	123.5260	127.9677	(44)
Energy conte	203.2359	179.0121	188.2123	160.6271	152.4419	133.7949	129.3842	136.4755	140.1472	160.5600	175.9854	200.3665	(45)
Energy content (annual)										Total = Sum(45)m =		1960.2433	
Distribution loss (46)m = 0.15 x (45)m	30.4854	26.8518	28.2318	24.0941	22.8663	20.0692	19.4076	20.4713	21.0221	24.0840	26.3978	30.0550	(46)

Water storage loss:	
Store volume	143.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.1280 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	0.6768 (55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(56)
If cylinder contains dedicated solar storage	20.9808	18.9504	20.9808	20.3040	20.9808	20.3040	20.9808	20.9808	20.3040	20.9808	20.3040	20.9808	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473	(64)
									Total per year (kWh/year) = Sum(64)m =			2207.2753	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	84.3606	74.6819	79.3652	69.6517	67.4716	60.7300	59.8049	62.1628	62.8422	70.1708	74.7583	83.4065	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	103.4751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.6375	15.6655	12.7400	9.6450	7.2098	6.0868	6.5770	8.5490	11.4745	14.5695	17.0047	18.1277	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	224.2868	226.6142	220.7492	208.2634	192.5023	177.6891	167.7930	165.4656	171.3306	183.8164	199.5774	214.3906	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	47.0721	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	-68.9834	(71)
Water heating gains (Table 5)	113.3879	111.1337	106.6737	96.7385	90.6876	84.3472	80.3829	83.5521	87.2808	94.3157	103.8310	112.1055	(72)
Total internal gains	436.8760	434.9772	421.7267	396.2107	371.9635	349.6869	336.3167	339.1305	351.6496	374.2653	401.9770	426.1877	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	7.8800	33.4622	0.6300	0.8270	0.7700	95.2051	(79)

Solar gains	95.2051	173.0844	247.4999	322.5774	357.6553	345.0938	336.8383	300.1802	265.5901	190.1488	117.1921	83.3220	(83)
Total gains	532.0811	608.0616	669.2266	718.7881	729.6188	694.7807	673.1549	639.3107	617.2397	564.4141	519.1691	509.5097	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	118.5486	118.5486	119.7210	123.3815	124.0134	126.6073	127.9454	127.9454	125.2970	122.1367	120.9168	121.5237	
alpha	8.9032	8.9032	8.9814	9.2254	9.2676	9.4405	9.5297	9.5297	9.3531	9.1424	9.0611	9.1016	
util living area	0.7538	0.6550	0.5470	0.4212	0.3246	0.2529	0.2020	0.2162	0.3024	0.4672	0.6492	0.7740	(86)
MIT	20.9702	20.9899	20.9978	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9996	20.9926	20.9661	(87)
Th 2	20.5483	20.5483	20.5526	20.5653	20.5674	20.5760	20.5802	20.5802	20.5717	20.5611	20.5568	20.5589	(88)
util rest of house	0.7369	0.6382	0.5313	0.4072	0.3110	0.2391	0.1881	0.2015	0.2866	0.4491	0.6302	0.7576	(89)
MIT 2	20.5170	20.5380	20.5504	20.5651	20.5674	20.5760	20.5802	20.5802	20.5717	20.5607	20.5495	20.5230	(90)
Living area fraction										fLA = Living area / (4) =		0.5576	(91)
MIT	20.7697	20.7900	20.7999	20.8075	20.8086	20.8124	20.8143	20.8143	20.8105	20.8054	20.7965	20.7701	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7697	20.7900	20.7999	20.8075	20.8086	20.8124	20.8143	20.8143	20.8105	20.8054	20.7965	20.7701	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7453	0.6472	0.5400	0.4150	0.3186	0.2468	0.1958	0.2097	0.2954	0.4592	0.6405	0.7655	(94)
Useful gains	396.5380	393.5486	361.3857	298.2777	232.4448	171.4613	131.8200	134.0489	182.3141	259.1802	332.5508	390.0548	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	405.8027	396.6690	362.0545	298.3300	232.4487	171.4615	131.8201	134.0489	182.3155	259.2946	334.8115	400.5712	(97)
Space heating kWh	6.8930	2.0969	0.4976	0.0377	0.0029	0.0000	0.0000	0.0000	0.0000	0.0851	1.6276	7.8241	(98a)
Space heating requirement - total per year (kWh/year)												19.0650	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	6.8930	2.0969	0.4976	0.0377	0.0029	0.0000	0.0000	0.0000	0.0000	0.0851	1.6276	7.8241	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												19.0650	
Space heating per m2											(98c) / (4) =	0.3726	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	6.8930	2.0969	0.4976	0.0377	0.0029	0.0000	0.0000	0.0000	0.0000	0.0851	1.6276	7.8241	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													

	6.8930	2.0969	0.4976	0.0377	0.0029	0.0000	0.0000	0.0000	0.0000	0.0851	1.6276	7.8241 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473 (64)
Efficiency of water heater												100.0000 (216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month												
	224.2167	197.9625	209.1931	180.9311	173.4227	154.0989	150.3650	157.4563	160.4512	181.5408	196.2894	221.3473 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	8.9074	8.0454	8.9074	8.6201	8.9074	8.6201	8.9074	8.9074	8.6201	8.9074	8.6201	8.9074 (231)
Lighting	15.4380	12.3850	11.1513	8.1699	6.3107	5.1559	5.7568	7.4829	9.7196	12.7526	14.4040	15.8671 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-10.9944	-18.6173	-31.6417	-41.8588	-49.0561	-46.3351	-45.9986	-40.4939	-32.7321	-22.8868	-13.0643	-9.4500 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.0435	-5.2214	-12.2897	-22.0235	-30.4942	-30.1810	-30.2340	-23.4124	-15.7721	-7.8122	-2.9511	-1.6227 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	19.0650 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	100.0000
Water heating fuel used	2207.2753 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)	
mechanical ventilation fans (SFP = 0.7000)	104.8780 (230a)
Total electricity for the above, kWh/year	104.8780 (231)
Electricity for lighting (calculated in Appendix L)	124.5936 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-547.1869 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1908.6251 (238)

10a. Fuel costs - using BEDF prices (540)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	19.0650	25.1600	4.7968	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	25.1600	555.3505	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	104.8780	25.1600	26.3873	(249)
Energy for lighting	124.5936	25.1600	31.3478	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1291	25.1600	-91.3633	
PV Unit electricity exported	-184.0578	5.8100	-10.6938	
Total			-102.0570	(252)
Total energy cost			515.8253	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	19.0650	0.1612	3.0737	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2207.2753	0.1413	311.7942	(264)
Space and water heating			314.8679	(265)
Pumps, fans and electric keep-hot	104.8780	0.1387	14.5479	(267)
Energy for lighting	124.5936	0.1443	17.9827	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1291	0.1319	-47.8936	
PV Unit electricity exported	-184.0578	0.1230	-22.6361	
Total			-70.5297	(269)
Total CO2, kg/year			276.8688	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	19.0650	1.5966	30.4390	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2207.2753	1.5223	3360.2168	(278)
Space and water heating			3390.6558	(279)

Pumps, fans and electric keep-hot	104.8780	1.5128	158.6595 (281)
Energy for lighting	124.5936	1.5338	191.1059 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-363.1291	1.4873	-540.0823
PV Unit electricity exported	-184.0578	0.4513	-83.0740
Total			-623.1563 (283)
Total Primary energy kWh/year			3117.2649 (286)

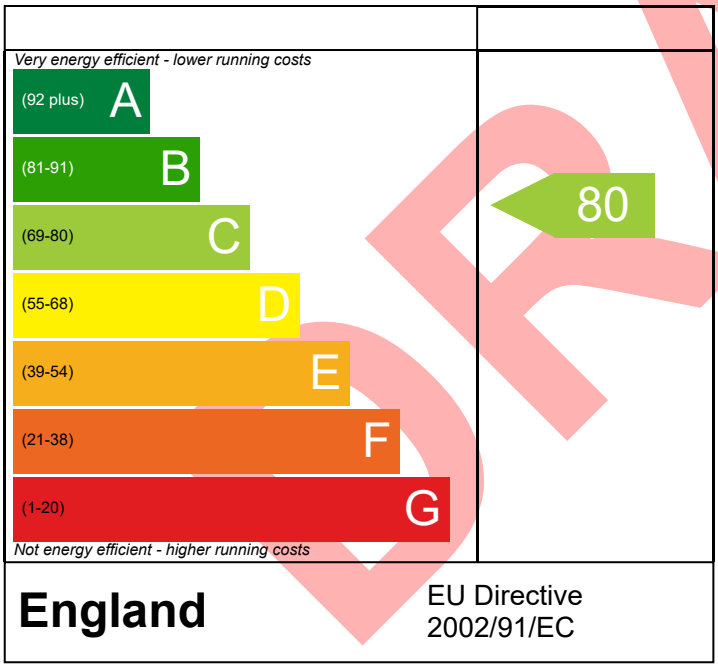
Predicted Energy Assessment

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	01/05/2024
Produced by:	Cairn Pearson
Total floor area:	51.17 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

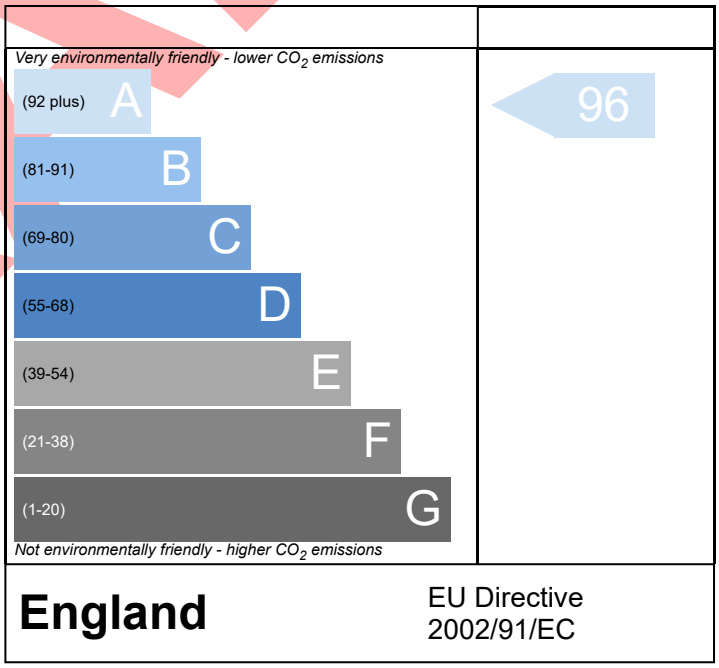
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

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